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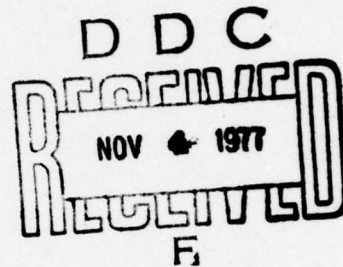
AN EXPERIMENTAL TEST FOR

GOAL CONGRUENCE

IN AN AIR FORCE MAJOR COMMAND

THESIS

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IN AN AIR FORCE MAJOR COMMAND

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Presented to the Faculty of the School of Engineering

of the Air Force Institute of Technology

Air University

in Partial Fulfillment of the

Requirements for the Degree of

Master of Science

by

Carl G. O'Berry, B.S.

Lt Col   USAF

Graduate Systems Management

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P R E F A C E

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                                        Carl G. O'Berry

Wright-Patterson Air Force Base, Ohio
August 1977

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The author adapted a

A B S T R A C T

The policy-capturing model frequently used in psycho-
logical research was adapted in this study to test for goal
congruence between managers at different levels of a large *U.S. Air Force*
service organization. of the U.S. Air Force. The data base
was derived from a field experiment wherein 660 military
officers and civilian managers were asked to make decisions
based on identical information cues. The decisions were
then grouped according to command level and a multivariate
linear regression model was derived for each group. An
F-test was used to compare these models *were compared* for equality of re-
gression coefficients, as a determinant of the effectiveness
of goal communication between organizational layers. The
linear regression model proved readily adaptable as an
analytical instrument for organizational study. The results
appeared reasonably conclusive, with significant differences
in decision-making behavior, *were* being indicated at different
command levels. Finally, a comparison of the decisions of
senior executives against those of various middle management
groups was made as a test of the importance of goal con-
gruence. It was found that the decisions of senior managers
and subordinate middle management groups, made under identi-
cal conditions, differed significantly in some cases. These
differences suggest that goal congruence within the Command
might have considerable importance, and that it might be im-
proved through a more effective management information sys-
tem.

Chapter I

INTRODUCTION

It is widely held among organization theorists and management specialists that organizations are goal oriented. Several excerpts from the literature on organizations serve to illustrate the nearly universal appeal of this assumption. Organizations are said to be:

"... [oriented] toward ends that are objects of common knowledge." (Simon, 1952, p. 1130)

"... [aimed at] some kind of collective goal(s) or output(s)." (Leavitt, 1963, p. 23)

"... devoted primarily to attainment of specific goals." (Etzioni, 1964, p. ix)

"... [structured for] obtaining a set of objectives or goals." (Litterer, 1965, p. 5)

"... [structured toward] achievement of some common explicit purpose or goal." (Schein, 1970, p. 9)

The assumption of goal orientation is restated so often in the literature that this assumption is accepted as axiomatic by most students of organization theory. Indeed, there seems to be little reason to doubt that _implicit_ goals are inherent to any organization; but most authors, as shown above, assume that organizations are oriented toward goals that are both _explicit_ and collectively understood by the organization membership. Furthermore, these explicit goals are assumed to be important motivators of individual behavior within the organization (Porter, Lawler & Hackman, 1975, p. 78).

The assumption of explicit goal orientation in organiza-

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tions has been challenged in recent years by several authors. Monsen and Downs (1965) hypothesized that senior managers in large organizations are motivated not by organizational goals but by the pervasive desire to maximize their individual lifetime incomes ("income" being measured in terms of money, power, prestige, or other personal considerations). This theory is extended organizationally downward through an added precept which states that middle managers strive to please their superiors, rather than attempting to satisfy organizational goals. Although the Monsen and Downs theory was directed primarily at private-sector organizations thought to be profit-maximizing entities, there is evidence suggesting that the theory is applicable to large public-sector organizations as well (Harrell, 1977). Another researcher suggests that the process of identifying and communicating organizational goals, which should be most exacting and carefully done, is more often than not a rather haphazard activity, because organizations are not inclined to devote the necessary resources to this process or lack the objectivity to do the job well (Manley, 1972, p. 1).

Regardless of an author's particular persuasion regarding goals and the goal-setting process, it seems generally agreed that clear, unambiguous goals, properly communicated within the organization, can aid substantially in promoting understanding of the organizational mission and in developing standards upon which to judge the performance of both people and units of activity.

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The Nature of Organizational Goals

Goals have been generally defined by organization theorists as desired future states of affairs (Porter, Lawler & Hackman, 1975, p. 78). While goals may not in some cases be attainable, organizations are viewed in general as intending to reach their established goals. Herbert Simon (1964, p. 2) classified organizational goals into two categories: official goals and operative goals. Official goals are viewed as the stated, sometimes cosmetic, acceptable goals of the organization, and they may be either very general or fairly specific. Some authors regard official goals as being primarily for external consumption (Manley, 1972, p. 3). Operative goals, on the other hand, are those goals which provide the bases for organizational policy formulation, operating decisions, development and application of information and control systems, and other management functions. Operative goals are considered to be in force whether or not there exists a conscious organizational goals-setting process, and they may be supportive of, indifferent to, or directly opposed to, the official goals of the organization (Manley, 1972, p. 3).

Communicating Organizational Goals

One persistent problem in large organizations is the difficulty of accurately communicating the goals of top management to those who must implement those goals. Such difficulty can stem from several sources. First, the communication process itself is subject to erroneous and mis-

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leading input/output. Second, biases, which are inherent to all groups of people, can limit accuracy in reception of managerial intent. Third, the views of groups, when continually reinforced by group members, can become virtually immune to change (Porter, Lawler & Hackman, 1975, p. 378). An example of the latter problem might be the continually reinforced view among civilians in a military organization that management goals will always favor military personnel. Finally, the accuracy of communicating top management goals can be adversely influenced by the "do as I say, not as I do" syndrome. This problem might develop when senior managers designate one set of goals, but make decisions inconsistent with those stated goals.

If the latter situation does occur, then subordinates are faced with the difficulty of correctly judging the operative goals of senior managers while more or less ignoring stated goals. In his Air Training Command experiment, Harrell (1975) sought to test the ability of middle-level managers to correctly interpret the desires of senior managers when those seniors acted at cross purposes to the stated goals of the organization. He found that subordinate managers readily ignored stated goals when feedback information revealed that their superiors had done so. Furthermore, Harrell's experiment indicated that middle managers would change their decisions, in opposition to stated policy, when they learned that their superiors' decisions were contrary to established goals. It thus became obvious that an

admonition to behave in a specified fashion is insufficient
to guarantee such behavior when a contrary example is set by
superiors.

Since Harrell's experiment was conducted entirely with-
in a single organizational level of the Air Training Command,
it might be reasonable to conclude that it would be even more
difficult to insure an accurate perception of top management
goals in a widely dispersed organization. Similarly, the
previously cited sources of difficulty in communicating
organizational goals would be amplified by wide geographical
separation of units within an organization.

Goal Congruence Between Organizational Levels

Goal congruence is defined by Horngren, a managerial
accountant, in a systems sense. That author asserts that a
managerial system must provide a global, or all-encompassing,
emphasis, so that major goals are considered whenever man-
agers act. The system must specify goals and subgoals to
encourage behavior that blends with, and supports, top man-
agement goals (Horngren, 1972, p. 155). In consonance with
this systems emphasis, goal congruence, as used here, is
intended to imply general agreement between the decisions
made by managers at all organizational levels, given the same
specified set of goals upon which to base those decisions.
Stated another way, goal congruence may be said to exist when
different managers assign the same relative importance to
stated goals in making a specified decision. This research
effort was initiated to determine whether or not such goal

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congruence exists between managers at different organization-
al levels and units of the Air Force Communications Service
(AFCS), a large and widely dispersed support command of the
United States Air Force.

AFCS Command Structure

The Air Force Communications Service is organized
essentially as shown in Figure 1-1. Excepting the Northern
and Southern Communications Areas, the commanders of the AFCS
Areas also serve as Deputy Chiefs of Staff (or Deputy Com-
manders) for Communications-Electronics for the major com-
mands they support. Due to differences in the missions sup-
ported by the Areas, each Area has its own staff structure,
as depicted by Figures 1-3 through 1-5. Figure 1-2 shows
the basic staff structure of the AFCS command headquarters.
Inasmuch as AFCS managers theoretically have an equal chance
of being assigned to any of the Areas, differences in staff
structure are not considered significant for purposes of
this study except to help illustrate the diversity of the
support provided by AFCS. The wide variety of combat missions
supported by the Areas, however, is significant, as is the
vast geographical dispersion of the Command. Figures 1-6
through 1-8 serve to illustrate both the geographical
separation of the operating units under each Area and the
considerable span of control of each Area commander. The
operating units vary in personnel strength from less than
50 to several hundred. The total strength of the Command
is nearly 46,000, making it one of the six largest commands

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in the Air Force.

Management Information Systems

There are several ways in which AFCS managers receive and dispatch information and guidance. In addition to interfaces between headquarters and subordinate unit counterparts, conferences are held at the Area level for various segments of the unit management staffs. There are also various reporting systems which assist the higher command echelons in maintaining visibility and control over field unit activities. These reporting systems tend to be one-way (upward) systems, and there is little immediate information feedback to the reporting units. Furthermore, there is an absence of lateral information transfer systems; hence, the operating groups and squadrons do not frequently exchange information.

The Operating Unit Environment

AFCS operating units are tenant organizations on the bases they support. In effect, AFCS has contracts with the various mission elements of the Air Force to provide communications and air traffic control operating, maintenance, planning, programming, engineering, and installation services. These agreements, in general, require that AFCS provide trained personnel to engineer, install, operate, and maintain communications-electronics and air traffic control facilities which are the real property of the using command. The methods of providing these services are in many ways analogous to methods employed by service agencies in the private

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sector.

Rating of Operating Units and Managers

The AFCS field operating unit (group, squadron, or detachment) is essentially loaned or leased to the using base or agency, while AFCS retains the prerogative of managing the personnel resources of these highly technical units. An operating unit commander typically serves two masters: he is responsible directly to his next higher AFCS commander, but he is also directly responsible to the base, wing, or other commander whom his unit supports. His Officer Effectiveness Report, which is the primary instrument by which he is promoted in grade, is prepared by the person to whom his unit provides the specified services; that is, the non-AFCS base commander or wing commander whom the AFCS unit has been tasked to support. The Officer Effectiveness Report is then forwarded to the appropriate next higher AFCS headquarters for review and indorsement; thus, it is obviously in the best interest of the unit commander to optimize his relationships with both his local superior and his AFCS superiors. It seems reasonable to hypothesize that pressures external to AFCS might be expected to have an important role in the response of the field unit commanders to AFCS goals and policies.

Figure 1-9 shows the internal organization of a typical AFCS field unit serving a Strategic Air Command (SAC) base. This unit structure changes in both subtle and obvious ways in units supporting other commands, whose mission require-

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ments may differ widely from those of SAC. These differ-
ences, along with the geographical separation of units and
varying degrees of identification of AFCS units with the
supported organizations, tend to create difficulty in com-
paring AFCS units in terms of performance. Also the stan-
dards against which the effectiveness and efficiency of AFCS
units might be compared tend to vary as the policies, pro-
cedures, and requirements of the users of the services pro-
vided.

Objectives of the Study

This study was conducted under the sponsorship of
Headquarters, Air Force Communications Service, Richards-
Gebaur Air Force Base, Missouri. It was intended to test
for goal congruence between various management levels of
that Command. The specific objectives of the study were as
follows:

a. To isolate and define a set of goals considered by
the AFCS headquarters staff to be important to effective AFCS
mission accomplishment, and to translate these goals into
specific decision criteria.

b. To determine the relative importance placed on each
of the above goals by the senior AFCS headquarters staff and
by other managers throughout the Command.

c. To compare the values thus determined and to ex-
tract from this comparison, if possible, some measure of
the degree of goal congruence between the various managers
and managerial groups.

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Scope and Limitations of the Study

Because a wide spectrum of AFCS management personnel was chosen to participate in the data collection effort associated with this study, it was hoped that the results of the research might be indicative of the decision behavior of managers throughout the Command. It is not expected, however, that these study results would be applicable to other Air Force commands or to other military service organizations. The AFCS mission is extremely complex and the Command employs a highly technical work force. Consequently, management of the Command demands skilled engineers, computer specialists, mathematicians, and other well educated and trained managers. Furthermore, the wide separation of AFCS units requires managers to operate with considerable independence and provides wide latitude for decision-making. These are factors not frequently found in the military management environment, particularly at the middle management level.
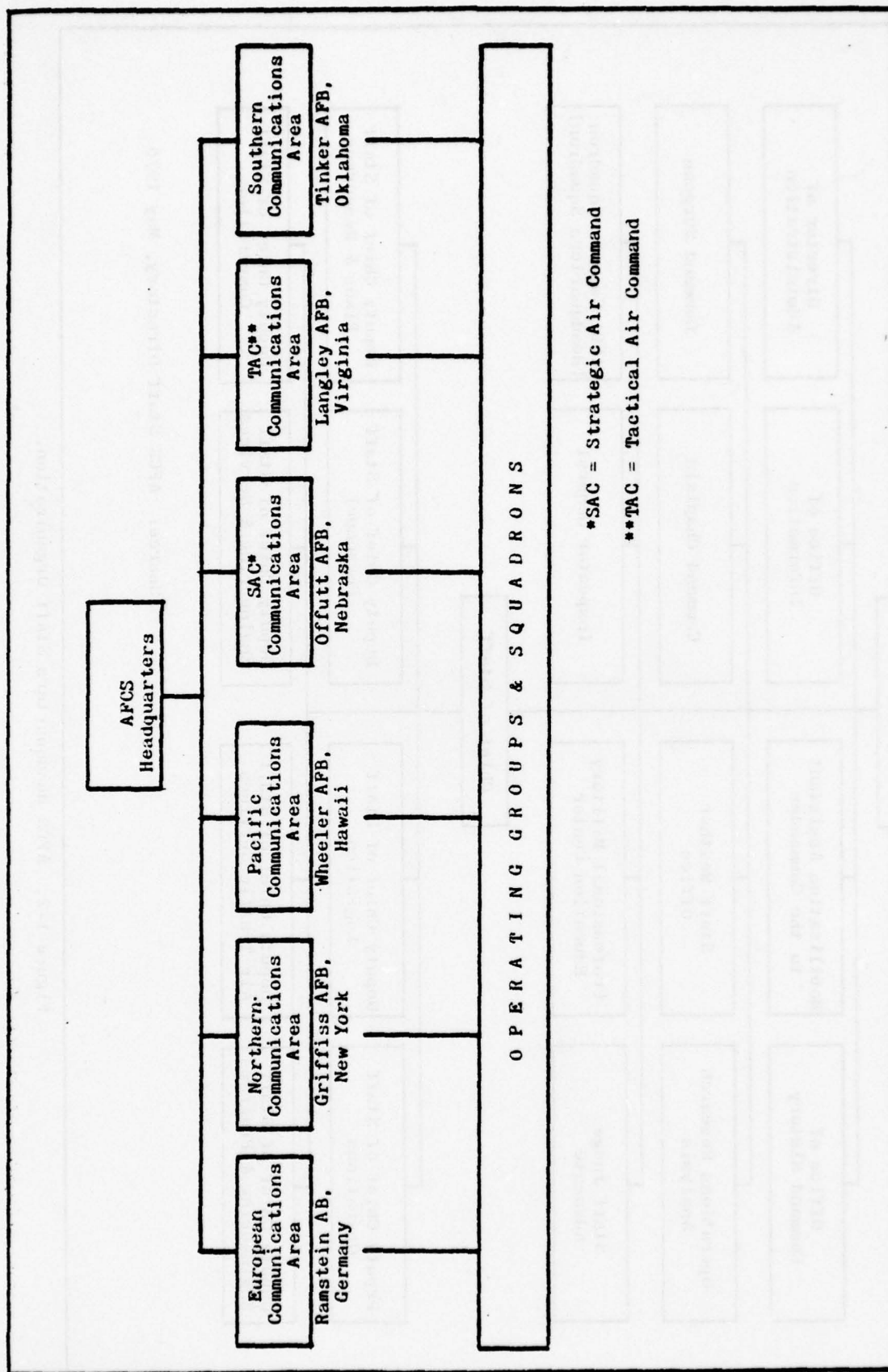
Figure 1-1. Organization of Air Force Communications Service.

AFCS
Headquarters

European Communications Area
Ramstein AB, Germany

Northern Communications Area
Griffiss AFB, New York

Pacific Communications Area
Wheeler AFB, Hawaii

SAC* Communications Area
Offutt AFB, Nebraska

TAC** Communications Area
Langley AFB, Virginia

Southern Communications Area
Tinker AFB, Oklahoma

OPERATING GROUPS & SQUADRONS

*SAC = Strategic Air Command

**TAC = Tactical Air Command

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Figure 1-2. AFCS Headquarters Staff Organization.

Source: AFCS Staff Directory, May 1976

Figure 1-3. Northern Communications Area Staff Organization.
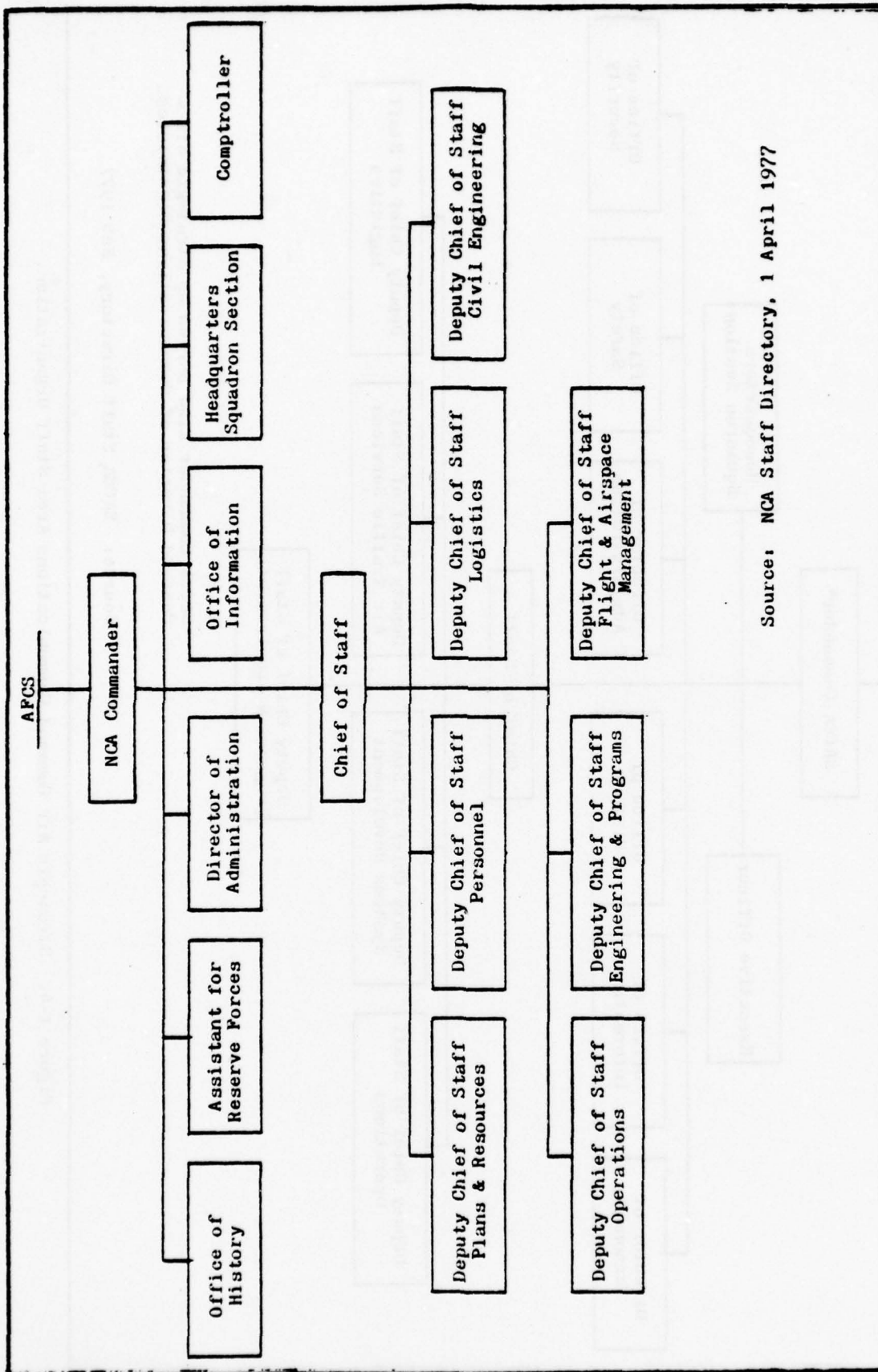
Source: NCA Staff Directory, 1 April 1977

AFCS

NCA Commander

Office of History

Assistant for Reserve Forces

Director of Administration

Office of Information

Headquarters Squadron Section

Comptroller

Chief of Staff

Deputy Chief of Staff Plans & Resources

Deputy Chief of Staff Personnel

Deputy Chief of Staff Logistics

Deputy Chief of Staff Civil Engineering

Deputy Chief of Staff Operations

Deputy Chief of Staff Engineering & Programs

Deputy Chief of Staff Flight & Airspace Management

Figure 1-4. Strategic Air Command Communications Area Staff Organization.

AFCS

SACCA Commander*

Executive Officer

Headquarters Squadron Section

Director of Personnel

Office of Information

Office of History

Director of Administration

Office of Safety

Office of Security

Chief of Staff

Deputy Chief of Staff Operations

Deputy Chief of Staff Systems Development

Deputy Chief of Staff Air Traffic Services

Deputy Chief of Staff Logistics

Deputy Chief of Staff Programs & Requirements

*SACCA Commander also serves as Strategic Air Command Director of Communications-Electronics.

Source: SACCA Staff Directory, Feb 1977

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Figure 1-5. Tactical Communications Area Staff Organization.

AFCS

TCA Commander*

Executive Officer

Headquarters Squadron Section

Director of Personnel

Office of Information

Comptroller

Director of Administration

Office of Safety

Security Police

Deputy Chief of Staff Fixed Communications

Deputy Chief of Staff Mobile Communications

Deputy Chief of Staff Logistics

Deputy Chief of Staff Plans & Programs

Deputy Chief of Staff Air Traffic Control

Assistant for Reserve Affairs

*TCA Commander also serves as Tactical Air Command Deputy Chief of Staff/Communications-Electronics.

Source: TCA Staff Directory, 1 April 1977

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Northern Communications Area, Griffiss AFB, New York

1974 CG* Scott AFB, Illinois	2044 CG Pentagon Washington, D.C.	2045 CG Andrews AFB, Maryland	2046 CG Wright-Patterson AFB, Ohio	2049 CG McClellan AFB, California
485 EIS** Griffiss AFB, New York	1828 EIS Wright-Patterson AFB, Ohio	1833 EIS McClellan AFB, California	1844 EES*** Griffiss AFB, New York	
1876 CS**** USAF Academy, Colorado	1879 CS Richards-Gebaur AFB, Missouri	1881 CS Hill AFB, Utah	1901 CS Travis AFB, California	
1905 CS McChord AFB, Washington	1917 CS Westover AFB, Massachusetts	1936 CS Lajes Field, Azores	1963 CS Chanute AFB, Illinois	
1987 CS Lowry AFB, Colorado	1998 CS McGuire AFB, New Jersey	2004 CS Sondestrom AB, Greenland	2014 CS Hanscom AFB, Massachusetts	
2016 CS Dover AFB, Delaware	2019 CS Griffiss AFB, New York	2031 CS Selfridge ANGB, Michigan	2034 CS Mather AFB, California	2104 CS Gentile AFS, Ohio

*CG = Communications Group
**EIS = Electronic Installation Squadron
***EES = Electronic Engineering Squadron
****CS = Communications Squadron

Figure 1-6. Northern Communications Area Unit Composition.

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Strategic Air Command Communications Area, Offutt AFB, Nebraska

1st Aerospace CG*
Offutt AFB,
Nebraska

33 CG
March AFB,
California

46 CG
Barksdale AFB,
Louisiana

392 CG
Vandenberg AFB,
California

17 CS**
Beale AFB,
California

44 CS
Ellsworth AFB,
South Dakota

90 CS
Warren AFB,
Wyoming

91 CS
Minot AFB,
North Dakota

308 CS
Little Rock AFB,
Arkansas

321 CS
Grand Forks AFB,
North Dakota

341 CS
Malmstrom AFB,
Montana

351 CS
Whiteman AFB,
Missouri

381 CS
McConnell AFB,
Kansas

390 CS
Davis-Monthan AFB,
Arizona

1883 CS
Kinchloe AFB,
Michigan

1915 CS
Grissom AFB,
Indiana

1916 CS
Pease AFB,
New Hampshire

1993 CS
Dyess AFB,
Texas

2001 CS
Sawyer AFB,
Michigan

2030 CS
Wurtsmith AFB,
Michigan

2032 CS
Rickenbacker AFB,
Ohio

2035 CS
Castle AFB,
California

2039 CS
Fairchild AFB,
Washington

2042 CS
Plattsburg AFB,
New York

2048 CS
Carswell AFB,
Texas

2101 CS
Blytheville AFB,
Arkansas

2192 CS
Loring AFB,
Maine

*CG = Communications Group
**CS = Communications Squadron

Figure 1-7. Strategic Air Command Communications Area Unit Composition.

Tactical Communications Area, Langley AFB, Virginia

2nd CCG*
Patrick AFB,
Florida

4th CCG
Langley AFB,
Virginia

5th CCG
Robins AFB,
Georgia

1998 CG*
Albrook AFB,
Canal Zone

1877 CS***
Holloman AFB,
Florida

1878 CS
Moody AFB,
Georgia

1882 CS
Bergstrom AFB,
Texas

1903 CS
Davis-Monthan AFB,
Arizona

1908 CS
England AFB,
Louisiana

1913 CS
Langley AFB,
Virginia

1928 CS
MacDill AFB,
Florida

1942 CS
Homestead AFB,
Florida

2012 CS
Seymour-Johnson AFB,
North Carolina

2020 CS
Shaw AFB,
South Carolina

2036 CS
Mountain Home AFB,
Idaho

2037 CS
Luke AFB,
Arizona

2040 CS
Cannon AFB,
New Mexico

2066 CS
Myrtle Beach AFB,
South Carolina

2067 CS
George AFB,
California

2068 CS
Eglin AFB,
Florida

2069 CS
Nellis AFB,
Nevada

*CCG = Combat Communications Group
** CG = Communications Group
*** CS = Communications Squadron

Figure 1-8. Tactical Communications Area Unit Composition.

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Figure 1-9. AFCS Squadron Organization.

SAC Bomb Wing Deputy Commander Operations

AFCS Area Commander

AFCS Unit Commander

Operations
- Cryptographic Accounting
- Telephone Operations
- Radio Operations
- Technical Control
- Record Comm* Operations

Plans & Programs

Maintenance
- Telephone/Wire Maintenance
- Maintenance Management
- Materiel Control
- Radio/TV Maintenance
- Navaids** Maintenance
- Computer Maintenance
- RADAR Maintenance
- Cryptographic Maintenance
- Record Comm Maintenance

Tactical Communications

Air Traffic Control
- Tower Operations
- RADAR Operations

Typical Organization of AFCS Communications Squadron Supporting Strategic Air Command Bombardment Wing.

*Record Communications (e.g., teletype, Automated Digital Network)

**Navaids = Navigational Aids (e.g., Instrument Landing Systems)

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Chapter II

MODELING HUMAN JUDGEMENT

It has been argued frequently and vehemently that human judgement is too complicated to predict with any real accuracy, and this might well prove true if one attempted to build a model for predicting the response of a particilar individual to non-specific external stimuli. Arguments citi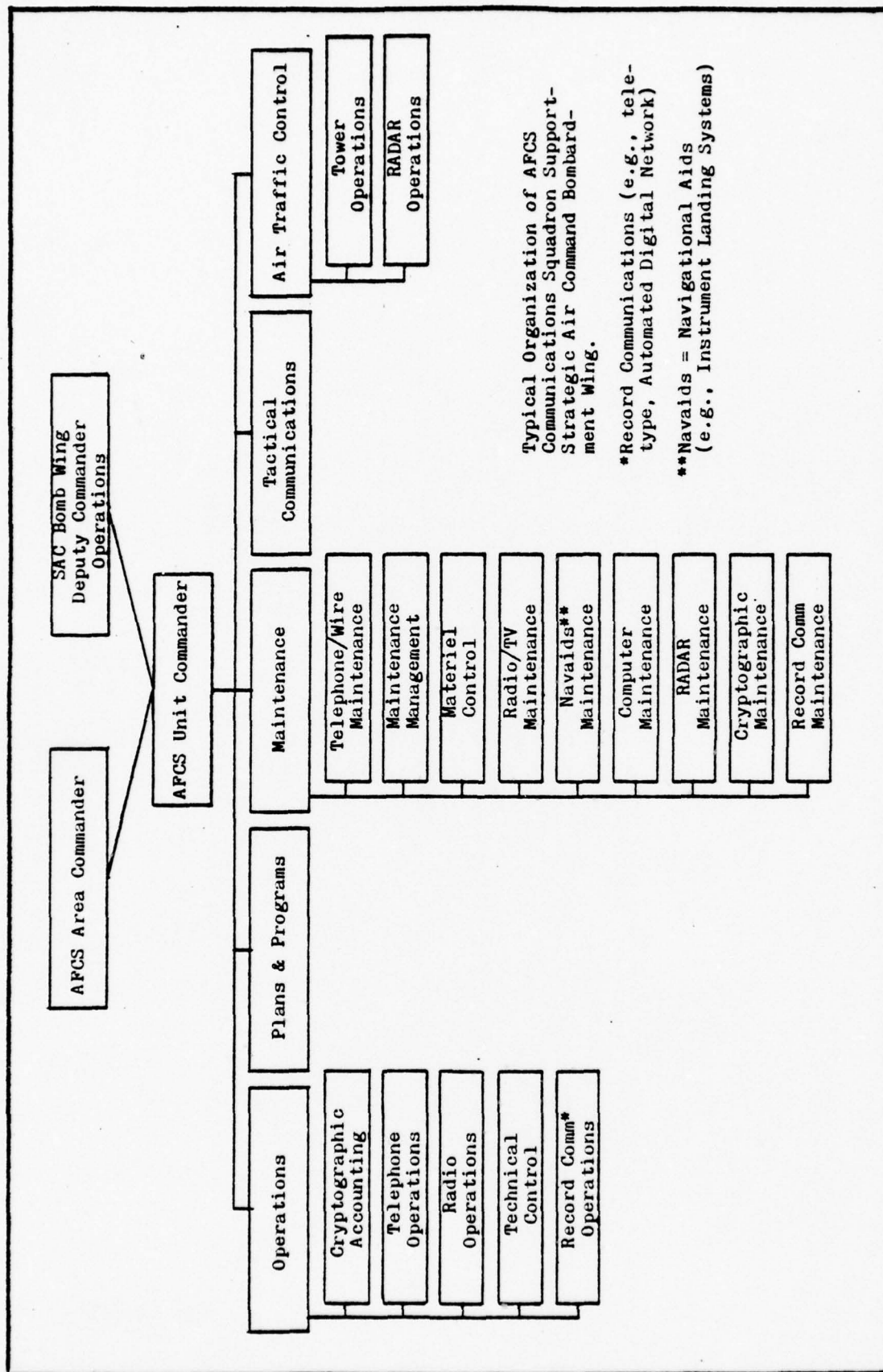ng the complexity of the human decision process appear to stem from several factors. First, the utilization of external stimuli, or cues, to arrive at decisions seems to be dependent upon numerous environmental, educational, and experiential behavior elements learned over time by every individual. Second, the process of decision-making, or judgement, is apparently not a purely intellectual one, or even an intellectual/emotional process alone. Judgement also seems to involve physiological dynamics, such as the individual's state of physical health, his diet, and a plethora of chemical/hormonal balances and imbalances. Finally, the human judgement process appears to incorporate varying degrees of intuition, ranging from nearly logical inferences to insights that are hardly short of incredible.

Despite the arguments against attempting to simulate or model the human judgement process, there are numerous authors who believe that this problem does not involve modeling the complex decision process itself, but only the

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manner in which humans use available information in making decisions. Consequently, the attention of many specialists (social scientists, in particular) has begun to focus on the process of integrating information for the purpose of predicting human judgement. In the opinion of some experts the real issues in simulating human judgement are the questions of what the individual does with available information and what he should be doing with that information. The first question involves the psychology of how individuals use information while the second question seems to be more practical, involving the attempt to make the decision process more efficient (Slovic & Lichtenstein, 1971, p. 652).

A number of mathematical models have been proposed for capturing human judgement policies. The model used in this study was the linear model suggested by Hoffman (1960), which is based, in turn, upon the lens model presented by Brunswick (1952). Without reiterating the details of the work of Hoffman and Brunswick, whose efforts are well-known in the field of psychology, let it suffice to say that the linear model is founded upon the notion that a judge's decisions represent linear combinations of the available stimuli, or cues.

Linear Regression Models

The work of Brunswick, Hoffman, and many others interested in modeling human judgement is based upon the process of fitting data to a linear equation through the method of least squares regression. The resulting equation is referred

to as a regression model. It contains a criterion variable and one or more predictor variables in a linear combination described mathematically by coefficients which are derived through the least squares procedure. Given specified information cues, the criterion can be predicted from linear combinations of these cues by the following general regression equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_i X_i + \epsilon$$

where the coefficients (β_0, β_i, i = 1, 2, ..., k) are the parameters of the model and ϵ is an error term which accounts for any variance in Y not explained by the predictors (X_i) in the least squares regression. It should be noted that the term "linear" refers to linearity in the parameters of the regression model and not to the predictors; hence, a regression equation such as

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2^2 + \epsilon$$

is a second-order (in X) linear (in the β's) regression model (Draper & Smith, 1966, p. 9).

In practice, it is not usually feasible to examine all possible occurrences of Y and X; therefore, statistical sampling is used to derive estimates of the actual parameters of the regression model. When judgement is represented by the linear regression model the estimates of the parameters thus derived, usually denoted as b_0, b_1, ..., b_k, are used to represent the relative importance given to each

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cue by the judge in arriving at his decision (Y) (Slovic & Lichtenstein, 1971, p. 659). Hoffman (1960) proposed an alternative index, which he called "relative weight", designed to better represent the importance placed on each cue by the judge. Relative weights are calculated from the parameters of the regression model and the squared multiple correlation coefficient (R^2) derived from the regression, as follows:

$$RW_{iY} = \frac{b_{iY}r_{iY}}{R_Y^2}$$

where RW_{iY} is the relative weight of the predictor X_i with respect to the decision Y (the regression model criterion variable), b_{iY} is the standardized regression coefficient (usually called the beta-weight) yielded by the least squares regression of Y with the predictor X_i, and r_{iY} is the intercorrelation coefficient between the predictor variable X_i and the decision Y. R_Y^2 is, as indicated above, the squared multiple correlation coefficient for the regression. This latter coefficient indicates the proportion of variance in the decision Y which is explained by the regression.

As will be seen later, the policy-capturing technique employed for this study involves the use of orthogonal (independent) predictors in the regression equation. In this special case, the intercorrelation coefficients and the beta-weights resulting from the regression are identical. The formula for calculating the relative weights of the predictors, therefore, reduces to:

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$$RW_{iY} = \frac{(b_{iY})^2}{R_Y^2}$$

Examples of Linear Modeling Applications

There is considerable justification in the literature for use of the linear model as a predictor of decisions by human judges. Slovic and Lichtenstein (1971, p. 679) cite more than 30 studies where researchers have very successfully represented various judges' idiosyncratic weighting policies with linear models. Such studies are tremendously diverse in the judgemental tasks to which the linear model has been applied. The tasks include judgements about personality characteristics, performance in school or on the job, physical and mental pathology, legal decisions, and various gambles, such as attractiveness of common stocks. In some cases the cues supplied were artificial and the judges were unfamiliar with the task. An example of this is a study where college students were asked to judge the intelligence of their peers on the basis of grade point average, aptitude test scores, and other such cues (Knox & Hoffman, 1962). In other cases, studies were made of judgements in complex but familiar situations by skilled decision-makers who, in addition to the cues included in the prediction equation, had other information available to them. The following excerpt provides examples of such cases:

> "... Kort (1968) modeled judicial decisions in work-men's compensation cases using various facts from the cases as cues. Brown (1970) modeled caseworkers' suicide probability estimates for persons phoning a metropolitan suicide prevention center; the

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cues were variables such as sex, age, suicide plan,
etc., obtained from the telephone interview. And
Dawes (1970) used a linear model to predict the
ratings given applicants for graduate school by
members of the admissions committee." (Slovic &
Lichtenstein, 1971, p. 679)

Further Rationale for Use of Linear Decision Models

Information processing by humans in the face of un-
certainty has long been a concern of psychologists and other
social scientists. Many studies have been conducted which
used various aspects of statistics as normative models in
the investigation of human behavior. The philosophical
basis for such studies is that man must often resort to
use of equivocal or probabilistic information in making de-
cisions about real world situations (Beach, 1967, p. 276).
In other words, man must frequently make judgements re-
garding situations about which he has incomplete informa-
tion.

In decisions involving uncertainty, man may not always
be as good a judge as the model of man. For example, one
study involved capturing the diagnostic policies of 29
clinical psychologists and forming a composite linear
model of those policies. It was found that the composite
model was nearly always more accurate than the individual
human judges in drawing clinical inferences because of the
elimination of a significant amount of the random error to
which the individual clinicians were prone (Goldberg, 1970,
p. 476). In another study, linear models were constructed
of 80 university judges' policies for predicting graduate

student grade point averages based on undergraduate grades, Graduate Record Examination scores, and other cues. These linear models were then used to forecast actual graduate grade point averages and the results were compared against first-hand predictions by the judges. In every case, the model proved superior to the judge from whom it was derived (Wiggins & Kohen, 1971, p. 105).

The results of the above studies and numerous others show clearly that the linear model is a powerful device for predicting quantitative judgements arrived at on the basis of specific cues; so much so, in fact, that many researchers seem to have concluded that the model is better at making decisions than the man being modeled. It seems reasonable to conclude, on the basis of this evidence, that the linear regression model *might* also be used as an effective analytical instrument for purposes such as the type of study described here.

Chapter III

RESEARCH METHODOLOGY

Identification of AFCS Goals

Since the objective of this study was to test for
goal congruence it was necessary at the outset to identify
a set of organizational goals which met several criteria,
as follows: (1) the goals must be realistic, operative goals
of the Command, (2) the goals must be unambiguous and reason-
ably independent of one another, and (3) the accomplishment
of the goals must be measurable.

Four AFCS goals which met the above requirements were
identified. First, AFCS strives to provide personnel support
programs to maximize retention of its skilled technical
personnel, to maintain high morale and esprit de corps, to
minimize disciplinary and complaint rates, and to provide
adequately for the welfare of the AFCS work force. Second,
the Command seeks to maximize the quality of the service it
provides to its customers. Third, compliance with AFCS di-
rectives is sought in this Command whose field units are
widely separated and often far removed from supervising
staffs. Finally, the Command seeks maximum effectiveness
and efficiency in repair and preventative maintenance of the
facilities for which it has responsibility.

Design of the Experimental Task

It was proposed in this study to employ a policy-
capturing technique similar to that suggested by Christal

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(1968b) and used by Harrell (1975) in his Air Training Command experiment. Accordingly, the above listed goals were translated into four predictor criteria for an experimental judgement task from which a linear model could be derived for each managerial entity to be tested.

Recalling the form of the basic linear regression model, and dealing henceforth only with the model applicable to the AFCS sample population, it would be well to address at this point the effect of independence in predictor criteria. The appropriate linear model for this study is

$$Y = b_1X_1 + b_2X_2 + b_3X_3 + b_4X_4 + \epsilon$$

where X_1 through X_4 are the predictor variables translated from the selected AFCS goals, as follows:

X_1 = Personnel Programs

X_2 = Quality of Service

X_3 = Compliance

X_4 = Maintenance Quality

The intention, following Harrell's 1975 example, was to devise an experimental task where AFCS judges are asked to evaluate, on an eight point scale, the performance of hypothetical operating squadrons. Each decision case contains information about whether each predictor variable is rated satisfactory or unsatisfactory. Since there are four predictors (which may be referred to as unit performance criteria) and only two states for each criterion (satisfactory or unsatisfactory), there are 2^4 = 16 possible

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combinations to consider; hence, each selected AFCS judge was asked to rate the performance of 16 hypothetical squadrons.

The use of satisfactory/unsatisfactory values for the judgement cues consigns the researcher's model to special status, since the sixteen decision tasks can each be represented by a mathematically orthogonal vector. This assures that the predictors themselves will be uncorrelated in the regression, which in turn provides that the "usefulness" of the performance criteria in arriving at the performance evaluation is strictly measured by the intercorrelation between each performance criterion and the decision (Darlington, 1968, p. 162). In other words, each of the sixteen evaluations made by the experimental subject is strictly characterized by the numerical value (1, 2, ..., 8) of his evaluation and one of sixteen orthogonal predictor vectors, each of which represents a unique performance state. It is thus quite simple to determine the importance the subject places on each of the four performance criteria.

Figure 3-1 clearly illustrates the orthogonality of the sixteen decision cases represented by assignment of ratings of S or U to a set of four decision criteria. Each of the digital equivalents of the sixteen cases can be read directly into the regression algorithm as a unique predictor vector.

The data collection instrument used for this study is

Case Number	Criterion Ratings	Predictor Vectors
1	U U U U	0 0 0 0
2	S U U U	1 0 0 0
3	U S U U	0 1 0 0
4	S S U U	1 1 0 0
5	U U S U	0 0 1 0
6	S U S U	1 0 1 0
7	U S S U	0 1 1 0
8	S S S U	1 1 1 0
9	U U U S	0 0 0 1
10	S U U S	1 0 0 1
11	U S U S	0 1 0 1
12	S S U S	1 1 0 1
13	U U S S	0 0 1 1
14	S U S S	1 0 1 1
15	U S S S	0 1 1 1
16	S S S S	1 1 1 1

Figure 3-1. Orthogonal Predictor Vectors Associated With Ratings of S or U for a Set of Four Decision Criteria.

presented in Appendix B. The sixteen cases were randomly

arranged in the exercise booklet by assigning an arbitrarily

selected random number from a random number table to each

case, with the cases listed as shown in Figure 3-1, then

sequentially listing the random numbers and the cases asso-

ciated with each number.

Collection of the Experimental Data

In agreement with AFCS, the researcher chose middle

management personnel at the Command headquarters, Northern

Communications Area (NCA), Strategic Air Command Communica-

tions Area (SACCA), Tactical Communications Area (TCA), and

the operating units under each Area for participation in

this experiment. Middle managers were defined as Air Force

officers in the grades of lieutenant through lieutenant

colonel and civilian managers in the grades GS-9 through

GS-13. It is this management segment which is largest in

number and which has the greatest responsibility for insur-

ing that AFCS organizational goals are met.

A sample of 80 managers was selected at each head-

quarters except TCA, where the entire population of 63

middle managers was asked to participate. The experimental

exercises were delivered personally by the author to each

of the Areas and to the Command headquarters. A project

officer was designated at each of these agencies to col-

lect the completed instruments and return them by mail to

the author.

A total of 360 operating unit personnel was selected

to participate in the exercise. These subjects received the experimental exercise by mail and were asked to return the completed instruments in self-addressed envelops provided for that purpose. A lower response rate was anticipated for the operating units because of the requirement to mail the data collection instruments; hence, a slightly higher proportion of potential subjects was selected from each of these populations than from those of the headquarters staffs.

The randomness of subject selection from each population was assured by the following process:

a. The AFCS Deputy Chief of Staff/Personnel prepared computer listings of middle managers assigned to the Command headquarters and each of the three Areas. Similarly, lists were generated which contained the names of management personnel assigned to the operating units, grouped by Area. Thus, a total of seven separate listings was created.

b. For each of the seven listings provided a random number was chosen from a random number table by arbitrary prior selection of a line and column number (e.g., line 54, column 12). This yielded a 5-digit random number from which, also by prior arbitrary choice, a two-digit number was selected (e.g., first two digits, last two digits, middle two digits). The two-digit number thus selected was used as the starting point on the personnel listing and from that point every nth person was selected, n being equal to the total number on the list divided by the desired sample size.

Selections were continued by counting on through the top
of the list as necessary.

Coding of Collected Data

When the completed data collection instruments were
returned, the information from each one was coded onto a
standard IBM card. Figure 3-2 shows the card format and
variable names used for the data base. The demographic data
for each judge were collected for use in a separate but re-
lated research effort being conducted simultaneously with
this study. The name of the subject was recorded in the
data base only if he requested an analysis of his performance
in the exercise, which was offered as an incentive to in-
crease the return rate. An example of the feedback provided
to those requesting it is presented in Appendix C.

Restructuring the Data for Regression Analysis

Each coded data card contained the numerical values
(1, 2, ..., 8) for every unit evaluation made by the sub-
ject, but did not contain the predictor vector associated
with each of the 16 decisions. Also, the 16 evaluations
were coded on the cards in a horizontal format, and the
CDC 6600 computer regression algorithm available to the
researcher requires that the regression variables be read
in line by line. Therefore, it was necessary to restructure
the data for regression analysis. To accomplish this, a
FORTRAN program was prepared which reads the numerical
values for the 16 decisions coded on each card and creates

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Card Columns*

1	2	3 4	5 6	7	8 9 10 11	12 13	14 15 16	17 18	19	20	21	22	23	24	25
STATUS	GRADE	DØRYR	DØRMØ	HDQ	UNIT	ØFFSYM	ASGYR	ASGNMØ	PME	CESTAFF	PRMAJCØM	PRTVL	EDTVL	EDFLD	ANRQ

Card Columns*

26 thru 41	42	43 44	45 thru 70
EVAL	UNDES	BØØKNR	NAME

Figure 3-2. Key to Coding of Exercise Data on Data Cards. Alpha or numeric values for each variable were entered exactly as coded by the experimental subject. The variable EVAL in columns 26-41 is the numerical value (1, 2, 3, ..., 8) of the 16 unit performance evaluations provided by the subject. Subject's name was entered only when he had requested an analysis of his performance in the experiment.

an n x 5 matrix for storage of each decision and its re-
spective predictor vector, n being 16 times the number of
subjects responding. The program adds the appropriate pre-
dictor vector to each evaluation, then stores the entire
matrix thus created, along with all the demographic data
for each subject, in a computer disk file. This disk
file is then attached by the regression program as required.
The FORTRAN program was prepared by Major C.W. McNichols, a
professor in the AFIT Systems Management Department, and
has general application possibilities for other studies of
this nature.

Additional Data Collected

In addition to the 663 data collection instruments
distributed to AFCS middle managers, the senior managers
of the Command were also requested to provide an input to
this study. The AFCS Chief of Staff and each of seven
deputy chiefs of staff was requested to provide the re-
searcher with the weight he felt should be given to each
of the four performance criteria in evaluating AFCS units.
This was accomplished by asking each senior manager to
divide 100 points between the four criteria. Then, each
of these senior executives was asked to complete the per-
formance evaluation task in the same manner as all other
subjects. The objective of this request was to provide a
means for comparing the perceived and actual importance
assigned to the performance criteria by the most senior
managers of the Command with like data calculated from the

responses of the middle managers. An example of the explanatory letter sent to each senior manager is contained in Appendix B. Precautions were taken to protect the privacy of the senior respondents to this request, as shown in the sample explanatory letter.

Analysis of the Experimental Data

The analysis medium used for this study was the Aeronautical Systems Division (ASD) CDC 6600 computer, employing the Statistical Package for the Social Sciences (SPSS) multivariate regression algorithm (Nie, et al., 1975). Also, a number of FORTRAN programs were written by the author to facilitate use of the data output from the SPSS regression runs. A program was written to calculate the relative weights of the predictors in every regression and to compute the F-test value for comparing the regression models in each composite run. Another program was written to select data from the disk file and prepare the individual analyses for subjects requesting such analysis. Finally, the author modified another program, written by Major C. W. McNichols, to calculate the relative weights and multiple correlation coefficient for every respondent to the experimental exercise.

The SPSS regression algorithm is extremely flexible, providing several types of regression, tests for significance, and various statistics. The data for this study were subjected to step-wise regression in every case, and in every regression the evaluation variable (the subject's evaluation of unit performance) was regressed on X_1 through

X_4 (the unit performance criteria, listed in the order presented earlier). Appendix D contains examples of the SPSS regression program used and typical outputs from the regression runs completed for this study. A total of 28 separate regression models was generated in analyzing the data for this study, but this was easily accomplished with the useful selection features of the SPSS algorithm.

To assure generation of all the models required to address the basic research question, the matrix shown in Figure 3-3 was developed. The numbers along the horizontal and vertical sides of the matrix represent the 9 different regression groups listed at the bottom of the figure. A regression model was generated for every non-zero element in the matrix. Where a non-zero element appears at the intersection of like-numbered rows and columns, the associated regression run included only members of that one group. All other non-zero elements indicate composite groups included in the regression run. It is necessary to regress two groups together only once; therefore, there are no reversals indicated in the matrix (i.e., all elements below the diagonal are zero).

Testing for Statistical Differences Between Models

Each of the 28 regressions indicated above produced a model which was used to determine whether a statistically significant difference exists between two or more groups of AFCS managers. A statistically significant difference would indicate that the regression coefficients represent different

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	1	2	3	4	5	6	7	8	9
1	x	0	0	0	0	0	0	0	0
2	0	x	x	x	x	x	x	x	x
3	0	0	x	x	x	x	x	0	0
4	0	0	0	x	x	x	0	x	0
5	0	0	0	0	x	x	0	0	x
6	0	0	0	0	0	x	0	0	0
7	0	0	0	0	0	0	0	x	x
8	0	0	0	0	0	0	0	x	x
9	0	0	0	0	0	0	0	0	x

Regression Group	Unit
1	All Respondents
2	AFCS Headquarters
3	NCA Headquarters
4	SACCA Headquarters
5	TCA Headquarters
6	Combined Operating Units
7	NCA Units
8	SACCA Units
9	TCA Units

Figure 3-3. Regression Run Plan. All non-zero entries indicate requirements for an SPSS regression run involving the groups identified by the row/column intersection.

populations and, therefore, that the importance given to the performance criteria by at least one group in the comparison is significantly different from the others. The F-test used for comparisons in this study is described by G. C. Chow (1960, p. 599). The null hypothesis tested in each comparison is that there is no significant difference in the regression coefficients of the models being compared. The alternate hypothesis is that there is at least one model among those being compared whose regression coefficients are significantly different from the others. In other words, statistically different populations are involved. Rejection of the null hypothesis, for purposes of this study, is tantamount to stating that there are significant differences in the goals of the groups being compared. The level of significance used for all F-tests applied for this study was 0.05. The method of calculating the observation F value for testing the null hypothesis is shown in Appendix E.

Significance of R^2 in Orthogonal Predictor Models

One further aspect of models having orthogonal predictors is important to this study, and that is the significance of R^2, the squared multiple correlation coefficient for the regression. If a regression equation is generated for each individual judge making the same decision, using the same information cues, such an equation expresses completely the policy of that judge (Christal, 1968a, p. 26). Computation of the R^2 for each such model is then an

effective measure of the prediction efficiency of the judge, since variations about the predicted value of the decision variable are largely due to inconsistencies in application of the judge's policy.

When the predictors are uncorrelated, as in the case of the models used for this study, the value of R^2 can actually be viewed as a measure of the judge's consistency in applying his established weights to the predictors in making his 16 evaluations. This notion can be extended to models representing larger groups also, but it becomes relatively more obscure as judges are clustered together, for the following two reasons: (1) a greater number of random errors is introduced in larger groups of judges, and (2) each judge may be very consistent in applying his own policy, but the composite group may not reflect the same degree of consistency as the individual judges (will not, in fact).

The notion of using R^2 as a measure of rater consistency was important for evaluating the AFCS senior manager contributions to this study, and to providing feedback to those experimental subjects who requested it.

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Chapter IV

RESULTS OF THE EXPERIMENT

AFCS Response to the Experiment

As shown in Table 4-1, of a total of 671 experimental exercises distributed to AFCS managers 520 usable completed exercises were returned for analysis, resulting in an over-all response rate of 77.5%. As anticipated, the response rates among the operating units was somewhat lower than in the several headquarters agencies, where managers were concentrated in larger numbers and could be reached directly rather than requiring mail distribution of the exercise.

Managers contacted directly during this experiment almost invariably expressed keen interest in the research. There were also numerous expressions of interest in the form of written comments and suggestions which were returned with the exercises. The high interest of the Command is most notably reflected, however, in the 349 requests for analyses of individual performance in the exercise, a total which constitutes 68% of the exercise respondents.

Senior Manager Results

The seven returns from AFCS senior managers were subjected to separate step-wise regressions, then grouped together in a composite regression run. The results are displayed in Table 4-2.

The senior managers were extremely consistent in applying their individual evaluation policies, as evidenced

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Table 4-1. Experimental Exercise Distribution and Response Rates.

Management Group	Number of Exercises Distributed	Number of Usable Returns	Response Rate
Senior Staff	8	7	87.5%
Hq AFCS	80	70	87.5%
Hq NCA	80	62	77.5%
Hq SACCA	80	69	86.25%
Hq TCA	63	58	92.06%
NCA Units	134	102	76.12%
SACCA Units	119	85	71.43%
TCA Units	107	67	62.62%
Total	671	520	77.5%

by the mean R^2 of 0.91366; however, it is apparent that there are some significant differences in the policies of these senior executives. One senior manager (Number 1) placed 42% of his evaluation emphasis on the Compliance factor. Another (Number 5) weighted the Quality of Service factor at only 21%. These two findings are unusual, for AFCS managers who participated in the experiment generally rated the Quality of Service factor far higher than any other, while the Compliance factor was generally rated quite low (10-14%)

Another interesting aspect of the senior manager analysis is the comparison of the weights each manager indicated he believed should be applied to the predictors versus the weights he actually used in his unit evaluations. Of the five senior managers who submitted their perceived weights for the predictors, only one (Number 2) actually came close to applying those indicated weights. In most cases, the Quality of Service motive received significantly higher consideration in the exercise than the executives indicated they felt this factor should receive. This, of course, resulted in compensating differences in the weights given to the remaining predictors. This tendency to apply different weights than those specified seems to indicate that a valid comparison has been made between the stated and operative goals of senior AFCS executives, serving to demonstrate how the "do as I say, not as I do" syndrome can arise. There appears to be little question that the goals used by senior AFCS executives to formulate Command policy can represent

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Table 4-2. Senior Manager Analysis Results.

Senior Manager	Predictor	Beta Weight	Relative Weight	Perceived Weight	R^2
1	Personnel	.3077935	.10	--	.90526
	Service	.5129892	.29	--	
	Compliance	.6155870	.42	--	
	Maintenance	.4103913	.19	--	
2	Personnel	.5013947	.25	.25	.98771
	Service	.5682473	.33	.30	
	Compliance	.3008368	.09	.15	
	Maintenance	.5682473	.33	.30	
3	Personnel	.2961898	.09	.20	.97228
	Service	.7290826	.55	.35	
	Compliance	.3189736	.10	.20	
	Maintenance	.5012443	.26	.25	
4	Personnel	.4708236	.25	.20	.87094
	Service	.6591531	.50	.35	
	Compliance	.2197177	.06	.10	
	Maintenance	.4080471	.19	.35	
5	Personnel	.5178575	.28	.25	.95828
	Service	.4488098	.21	.25	
	Compliance	.3797622	.15	.20	
	Maintenance	.5869052	.36	.30	
6	Personnel	.1627577	.03	--	.82781
	Service	.7324096	.65	--	
	Compliance	.1627577	.03	--	
	Maintenance	.4882731	.29	--	
7	Personnel	.4160030	.20	.25	.87335
	Service	.7334790	.62	.28	
	Compliance	.2408438	.06	.22	
	Maintenance	.3229497	.12	.25	
All	Personnel	.3823280	.18	N/A	.82683
	Service	.6111227	.45	N/A	
	Compliance	.3006694	.11	N/A	
	Maintenance	.4656031	.26	N/A	

Consistency Index (Average R^2): 0.91366

a significant departure from the stated goals of such managers. The next question which comes to mind is: How well are the actual (operative) goals of these executives understood and supported by their subordinates and by units subordinate to the Command headquarters?

Results of the Main Data Base Analysis

The answer to the above question lies in the analysis of responses from the AFCS middle managers. The main body of the computation results is contained in Appendix F. This Appendix shows the relative weights computed for each group of AFCS managers, the beta-weights for each regression, the regression R^2 and residual sum of squares and, finally, the observed F value for testing goal congruence between the groups in each regression. Table 4-3 presents a summary of analytical results for middle managers similar to that provided earlier for senior manager results. All managerial groups in Table 4-3 and subsequent tables have been referred to by numerical designators. Identification of the groups is considered proprietary information and is not considered necessary to understanding of this report. Should the reader deem it essential to know such details, he should contact AFCS/OA, Richards-Gebaur AFB, Missouri 64030.

A superficial perusal of the middle management analysis results reveals what could be taken as striking similarities between the seven groups of managers. For example, four of the seven groups weighted the Quality of Service factor at exactly the same value (0.49). Similarly, the

Table 4-3. Middle Manager Analysis Results.

Management Group	Predictor	Beta Weight	Relative Weight	R^2
1	Personnel	.3534649	.16	.76104
	Service	.6076846	.49	
	Compliance	.2792534	.10	
	Maintenance	.4346199	.25	
2	Personnel	.3576236	.18	.72728
	Service	.5643008	.44	
	Compliance	.3332323	.15	
	Maintenance	.4121910	.23	
3	Personnel	.3302284	.14	.77875
	Service	.6301606	.51	
	Compliance	.3140704	.13	
	Maintenance	.4170775	.22	
4	Personnel	.3616129	.17	.77501
	Service	.6173115	.49	
	Compliance	.3252636	.14	
	Maintenance	.3967088	.22	
5	Personnel	.3221150	.14	.74185
	Service	.6039127	.49	
	Compliance	.3106724	.13	
	Maintenance	.4205441	.24	
6	Personnel	.2904820	.11	.77785
	Service	.6180874	.49	
	Compliance	.3445501	.15	
	Maintenance	.4390004	.25	
7	Personnel	.3044796	.12	.76711
	Service	.6241570	.51	
	Compliance	.3474526	.16	
	Maintenance	.4040994	.21	
All Subjects	Personnel	.3282215	.14	.75832
	Service	.6095076	.49	
	Compliance	.3212979	.14	
	Maintenance	.4193588	.23	

Consistency Index (Average R^2): 0.89016

rank ordering of the four performance criteria is the same
for six of the seven groups, the single exception being
Group 6 managers, who placed relatively more weight on the
Compliance factor than did the other groups. The rank or-
dering in all groups except Group 6 was as follows:

    X2 (Quality of Service)

    X4 (Maintenance Quality)

    X1 (Personnel Programs)

    X3 (Compliance)

For the Group 6 managers, the Compliance and Personnel cri-
teria were interchanged.

The relatively lower R^2 value for these groups compar-
ed with the individual R^2 of each of the senior managers is
readily explainable. Each manager applies his own evalua-
tion policy with a fairly high degree of consistency; how-
ever, when a number of individuals is taken as a composite
group, the apparent decision consistency is decreased due to
differences in individual evaluation policies. This is
proven by averaging the individual consistencies of all
respondents and comparing this averaged R^2 with the R^2 of
the combined regression runs. As shown in Table 4-3, the
consistency index for all 513 middle manager respondents
was 0.89016. The R^2 of the respondents combined as a group
was 0.75832. These findings are consistent with those from
the senior managers, whose group R^2 was 0.82683 while the
individual averaged R^2, or consistency index, was 0.91366.

This first, rather cursory glance at the analysis
findings seems to suggest a rather marked, Command-wide

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homogeneity in the decision behavior of AFCS managers; how-
ever, the real test of this apparent agreement lies in a
more rigorous comparison of the managerial groups.

F-Test Results

Employing the test detailed in Appendix E, appropriate
groups of middle management unit evaluations were compared
to determine whether any such groups represented decisions
by statistically different populations. As Appendix E
shows, the F-Test value is calculated using the residual
sums of squares of all regression models in the comparison.
The observed F value thus calculated is compared against the
appropriate value for a standard F distribution, at the
chosen level of significance, to decide whether or not to
reject the null hypothesis that all compared models have
statistically similar regression coefficients. Table 4-4
shows the AFCS management groups thus compared, the number
of decisions (N) made by each composite group, the appropriate
F values, and an indication of whether or not the null
hypothesis was rejected in each case. Figure 4-1 is a
more graphic portrayal of the F-Test results. The solid
lines in this figure are intended to indicate connections
between statistically similar populations, whereas the
broken lines between groups suggest differences in the
goals of the groups thus connected.

Although there are more rejections of the null hypo-
thesis than there are acceptances, it was considered pos-
sible that each group might simply be optimizing its own

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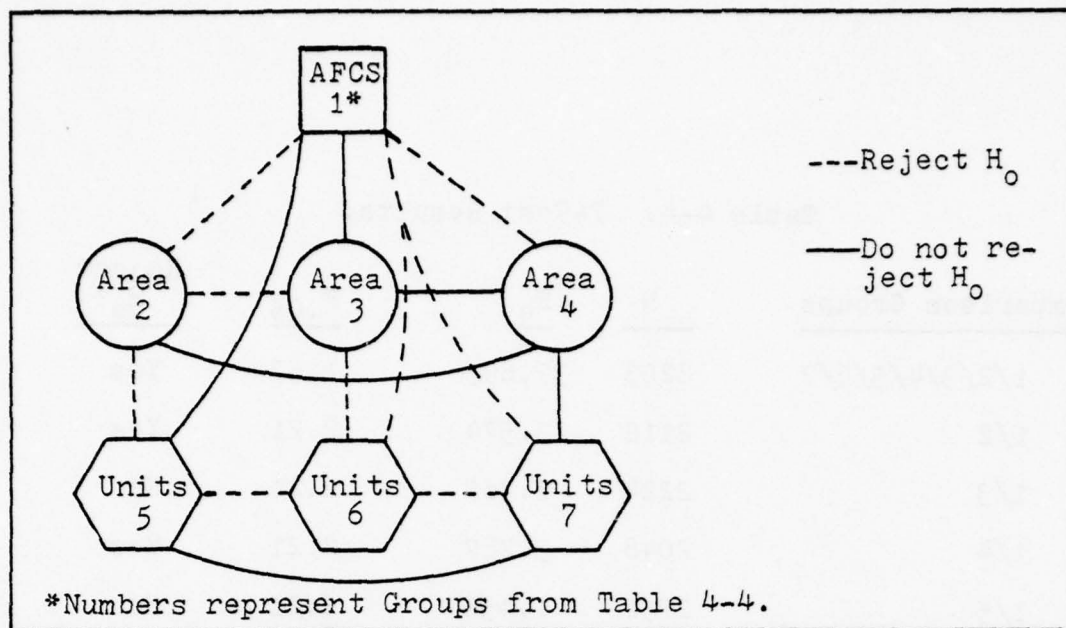
Figure 4-1. Graphic Depiction of F-Test Results.

slightly different goals to the same general effect. That
is, while the goals being considered in the managerial
decision process might be somewhat different for each group,
the decisions reached might still reflect the general policy
of the Command as a whole. To test this hypothesis, it was
necessary to establish a Command standard for evaluating
individual groups. Accordingly, it was reasoned that the
average weights used by the senior executives of the Command
in making identical decisions could be used as comparative
bases for determining whether the decisions of AFCS middle
managers represent the interests of the Command. This
seems natural and defensible, since the senior staff of-
ficers in the Command headquarters are the de jure policy-
setters for AFCS.

Table 4-4. F-Test Results.

Comparison Groups	N	F_O	$F_{.05}$	Reject H_O?
1/2/3/4/5/6/7	8208	37.895	1.57	Yes
1/2	2112	3.574	2.21	Yes
1/3	2224	1.387	2.21	No
1/4	2048	3.287	2.21	Yes
1/5	2752	1.452	2.21	No
1/6	2480	4.658	2.21	Yes
1/7	2192	4.826	2.21	Yes
2/3	2096	3.439	2.21	Yes
2/4	1920	1.819	2.21	No
2/5	2624	3.138	2.21	Yes
3/4	2032	1.712	2.21	No
3/6	2464	2.682	2.21	Yes
4/7	2000	1.947	2.21	No
5/6	2992	2.762	2.21	Yes
5/7	2704	1.323	2.21	No
6/7	2432	3.518	2.21	Yes

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Further Decision Comparisons

The Student t-Test described by Speigel (1975, p. 215) and by Freund (1971, pp. 317-318) was used to test the null hypothesis that the 16 evaluations made by each of the various AFCS management groups represented the same decisions as like evaluations made by the senior AFCS staff. This hypothesis, of course, was tested against the alternate hypothesis that the 16 decisions of each group were not the same as those made by the senior staff; thus, a two-tailed test was indicated, and a 0.05 level of significance was used. The formula for calculating the observed t value for each decision is as follows:

$$t_o = \frac{\overline{X}_i - c_i}{s_i/(n)^{\frac{1}{2}}}$$

where $\overline{X}_i$ is the mean of hypothetical unit evaluation i ($i = 1,2,\ldots,16$) calculated for all members of a given group, c_i is the mean of the same evaluation calculated from the seven senior manager responses, s_i is the standard deviation of the group evaluation being tested, and n is the number of respondents in the group sample.

It was realized that there are philosophical arguments against this approach, since obviously all seven senior managers did not precisely agree as to the goals of AFCS. This means, of course, that there is a statistical distribution involved in the senior manager decisions. Nonetheless, it was reasoned that these seven senior executives constitute a substantial majority of the policy-setting body of the Command; therefore, the mean of each of their 16 evaluations

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was viewed as a population parameter, rather than an esti-
mate, against which to compare the means of like decisions
by any given subordinate group.

Appendix G contains the actual t-Test scores calculated
for each middle management group; however, the comparison
results have been summarized in Table 4-5. This Table shows
that the Command senior executives and various middle manage-
ment groups agree on as few as 8 to as many as 12 of the 16
evaluations.

Table 4-5. t-Test Results

Middle Management Group	Number of Decisions Agreeing With Senior Staff	Percentage Of Agreement
1	12	75%
2	11	68.75%
3	12	75%
4	8	50%
5	12	75%
6	10	62.5%
7	11	68.5%

Sensitivity of the Regression Model

As a final note on the experimental results, the
sensitivity of the linear regression model was tested by
varying the values of a single evaluation in one model
through several regression runs. It was found that this
resulted in extreme differences in the multiple correlation
coefficient. For example, the regression intially produced
an R^2 value of 0.82781 with decision number 12 being valued
at 1.0. When this decision value was changed full range

to 8.0, the regression R^2 was reduced to 0.21579. Intermediate values in the range of the same decision resulted in corresponding R^2 variances; hence, the model is extremely sensitive to changes in the rating policy of the evaluator.

Chapter V

SUMMARY AND CONCLUSIONS

Summary

The Air Force Communications Service is a large, widely dispersed Air Force support organization with complex intracommand managerial interfaces. Such an organization inevitably has the potential for difficulty in communicating the goals and policies of its highest executives through its several managerial echelons to those who do the work of the Command. This research effort was initiated as an attempt to determine how successful the communication of Command goals is within AFCS. In other words, the research was intended to address the specific question of whether or not goal congruence exists among the various AFCS management levels.

The study methodology is a logical follow-on to the work of many contemporary social scientists who have used linear regression models to capture individual policy and predict human judgement. In this study, however, the linear model is used as an analytical instrument rather than a predictive one, in a manner similar to that used by Harrell (1975). The technique involves the use of controlled predictor variables as information cues for the experimental subject to employ in making decisions. In this study the predictors were cues related to four familiar operative goals of AFCS, as perceived by the researcher and agreed upon by the AFCS headquarters staff (See Appendix A). Each participant in the field experiment was asked to use

the cues provided him to evaluate the performance of 16 hypothetical AFCS squadrons. The evaluations thus provided by 513 AFCS middle managers, along with responses from seven of eight senior AFCS staff officers, were subjected to step-wise multivariate regression analysis, the data being grouped by management level and by unit within each level.

The results of the regression analysis, which provided eight separate linear regression models, were then compared to determine whether or not the unit evaluations of the various management groups were statistically different. It was found that goal congruence existed in five of the fifteen comparisons made. In comparisons between command levels, agreement was found between one of the three Areas and the Command headquarters and between the operating units of another Area and AFCS headquarters. Similarly, the operating units of only one Area were found to be in agreement with the Area headquarters.

To analyze the significance of these differences between command levels, a further test was made to determine whether the various management groups might be emphasizing different goals, but still making decisions compatible with those of the senior executives of the Command. It was found that the decisions of the subordinate groups of managers were compatible with those of the Command's senior managers in 50% to 75% of the decisions made.

A rather surprising outcome of the analysis was the relatively greater importance placed on Compliance by the

operating units vis-a-vis the Command headquarters. The intermediate headquarters staffs (Areas) also emphasized Compliance more than the Command headquarters, but less than the operating units.

One analytical result which AFCS should find very satisfying is the pervasiveness of the Service goal among its managers. While it is one thing to dictate the goals of an organization, it is quite another thing to find a single goal to be as powerfully operative throughout an organization as is the goal of service to the customer among AFCS middle managers. In every group studied the Service goal was by far the most important consideration in the management decisions made.

Conclusions

The following conclusions were arrived at after analysis of the experimental data:

a. There are significant differences in the goals emphasized by AFCS middle managers at different levels of that segment of the Command which participated in this study. As a result of these differences, it appears that the various groups of AFCS middle managers would make decisions that were different from those reached by the senior managers of the Command about 25% to 50% of the time.

b. The linear regression model is an effective analytical device for organizational studies involving goals and decision making. It is believed, on the basis of the author's literature review, that this is the first research

effort where the techniques of linear modeling have been used to capture the decision policies of a multilevel organization, or to test for goal congruence between organizational levels. It appears that this useful research technique might have wide application in many types of organizational analysis.

Further Implications of the Results

It seems likely that the degree of goal congruence between AFCS units participating in this study could be improved by the initiation of a management information system designed to provide a more efficient downward flow of policy information. AFCSR 100-17 (1975), AFCSR 124-1 (1974), AFM 65-110 (1975), and AFM 65-265(1973), among others, all specify information to be reported by the operating units to their respective Areas, and likewise by the Areas to AFCS headquarters, on a rather immediate basis; however, no references were found concerning similarly rapid downward or lateral information flow. Interviews with AFCS managers indicated that avenues for communicating new command policy appear to be limited to inspection reports, staff visit reports, infrequent conferences, and occasional visits by Area/AFCS headquarters commanders. The dissemination of command policy in general, of course, is done through the media of regulations, manuals, and other written guidance. It seems likely that some more immediate form of two-way management information exchange would improve goal congruence between command levels.

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The importance of Compliance at the lower levels of the command suggests that either there is a belief at the operating units that compliance is extremely important to higher AFCS levels or there is a perceivedneed to rely heavily upon higher command directives for guidance. Past experience of the researcher and discussion with others having AFCS command experience tends to negate the latter reasoning. With regard to the former rationale, discussions with the AFCS Inspector General have led to repeated assurances that Command emphasis on Compliance has dramatically decreased in the past two years. Experimental findings from among respondents at the Command headquarters tend to support this philosophy, yet the operating units apparently do not perceive a de-emphasis of Compliance by the various headquarters staffs. This paradox seems to suggest once again that the operative goals of the higher echelons are not being adequately communicated to the operating units.

Despite the apparent lack of goal congruence within the tested AFCS population, there is a high degree of consistency in the decisions of AFCS managers. This implies that AFCS managers are generally capable of incorporating their individual policies into the decision process in an unambiguous way, suggesting in turn a high degree of discipline and dedication. This tends to support once more the earlier implication that greater goal congruence within the Command is possible.

Finally, the hierarchical order in which the four performance criteria were entered into the step-wise

regressions was generally consistent throughout the study. This order being directly associated with the relative importance placed upon the criteria by the decision makers, it seems probable that, while different relative weights are assigned to the criteria by the various groups, there is general agreement on the viability of the goals chosen for this study. That is, there is little doubt that the four selected goals are operative within the Command.

Suggestions for Further Research

It would be interesting to extend this study into other AFCS units to determine whether or not the results could be generalized to the entire Command. In particular, since some of the greatest differences in operative goals appear to occur between the Command headquarters and units having some direct affiliation with other commands, it would probably be fruitful to analyze the remaining three Areas to determine if this apparent trend might be real.

Another interesting possibility for further research exists in the extension of Harrell's (1975) techniques to AFCS to test for the effects of policy cues and feedback in the experiment. These factors can provide much meaningful data on the probable effectiveness of management information systems, and might suggest a form of information system best suited to the Command.

Other Comments

There are several important points to be made relative to the above conclusions and implications, as follows:

a.   No attempt has been made in this study to state just how important goal congruence might be to AFCS. The literature tends to presume that goal congruence is a desirable state to be maintained within an organization. If the organization supports this assertion, then the lack of goal congruence would probably be considered a state which some attempt might be made to correct.

b.   So little work has been done in the area of testing organizations for goal congruence that it would not be possible or desirable at this point to imply in any way that there is more or less goal congruence in AFCS than in any other organization.

c.   No attempt was made in this study to say what goals of AFCS should be emphasized. In fact, no attempt has been made to say which of the four operative goals chosen for the study itself should by emphasized by AFCS managers.

Related Study

Another study is presently being conducted to determine whether or not some of the differences in goals found in this research effort might be related to the demographics collected with the experimental exercise. This second study will rely heavily on the Automatic Interaction Detection (AID) algorithm to compare the unit evaluations against such factors as the subject's grade, time in assignment, previous assignment, military/civilian status, education, etc. It is possible that some improvement in the predictive power of the linear models can be brought about by such demographic

groupings; however, it should be understood that the models derived in this study have been demostrated to be both very sensitive and quite powerful for the applications described here.

APPENDICES

A P P E N D I X   A

RESEARCH PROPOSAL/APPROVAL

REPLY TO
ATTN OF: OA   11 Jan 1977

SUBJECT: Research Proposal
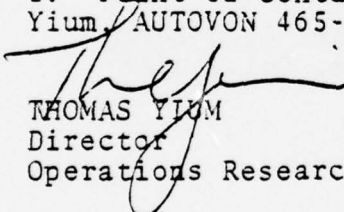
TO: Lt Col Carl G. O'Berry
4111 Silver Oak Street
Dayton, OH 45424

1. The research proposal shown in your letter of
1 Dec 1976 dealing with the goal congruence between
AFCS Headquarters and the six Areas and between the
Areas and the Operating Units has been reviewed, and
the following comments are offered:

a. We agree in principle with the proposal; the four
decision criteria (personnel, service quality, compliance
and maintenance quality) appear realistic and independent.
Moreover, they represent valid indicators which relate
to the decision making policies associated with this
Command.

b. The data collection method for the proposed
research should be coordinated with AFCS prior to actual
implementation. The anticipated requirements for AFCS
resources must be defined prior to final approval.

2. Point of contact at this Headquarters is Mr. Thomas
Yium, AUTOVON 465-3631, or (816) 348-3631.

THOMAS YIUM
Director
Operations Research Analysis Office

Providing the Reins of Command

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4111 Silver Oak Street
Dayton, Ohio 45424
1 December 1976

Mr. Thomas Yium
AFCS/OA
Richards-Gebaur AFB, MO 64030

Dear Tom:

Per our recent telephone discussion the attached
research proposal is forwarded for your consideration. I
will be free during the week of 20 December and can travel
to Richards-Gebaur for further discussion of the proposal
should you so desire. It may prove mutually advantageous
for us to get together to insure that we are in complete
agreement on decision criteria and research objectives. I
would appreciate hearing from you as soon as you have had the
opportunity to look the proposal over. I think we can do
a good job for you.

                          Regards,

                          Carl G. O'Berry
                          Lt. Col., USAF

<u>A Research Proposal</u>

Submitted to

Air Force Communications Service/OA

by

Carl G. O'Berry, Lt. Col., USAF

<u>Background</u>

1.   There are two unanswered questions pertaining to
the Air Force Communications Service management structure
which seem to occur to nearly every unit and Area commander
at one time or another.   These same questions also seem to
recur regularly within the staff agencies of both the Areas
and the command headquarters.   A general form taken by these
questions might be stated as follows:

a.   To what degree does the next higher command
level need to be involved with the day-to-day activities of
the operating unit/Area?

b.   How much decision-making autonomy should the
Headquarters grant to the Areas and the Areas to the
operating units?

2.   Both the above questions appear related to the need
(or lack of need) for some type of management information
system.   There has been an almost continuous attempt since
the early 1960's to satisfy varying requirements for infor-
mation at all AFCS command levels.   AFCSR 100-17 and AFCSR
125-1 both detail reporting requirements intended to keep
the command informed of activities at the units.   There are
also several other reporting systems which provide informa-
tion to the command, such as those prescribed in AFM 65-110

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and AFM 65-265. The questions persist, nonetheless, and it appears that it might prove fruitful to take a new approach to these questions.

3. If it can be established that the two questions cited above actually stem from a single basic question related to management of the command, then the picture can be somewhat simplified. This kind of simplification is suggested by a technique known in management accounting as goal congruence testing. Specifically, the need for management information systems can be tied to the one very precise question: Does goal congruence exist between the various echelons of the organization?

4. There are a number of techniques for analyzing an organization for goal congruence. Extensive work is currently being done in the area of statistical modeling for assessment of personal and organizational behavior, and this work is adaptable to the AFCS community. For example, multivariate regression analysis is a familiar statistical means for establishing relationships in behavior patterns. Regression analysis, coupled with the use of recently developed policy-capturing techniques, can be used to predict the behavior of individuals and groups with considerable accuracy.

5. The particular research problem proposed for your consideration is the following: Does goal congruence exist between AFCS Headquarters and the six Areas, and between the Areas and the operating units? Applying statistical analysis techniques to this question may reveal possibilities for application of innovative management ideas. By carefully

choosing the analytical techniques, insuring the gathering
of unbiased data through random selection processes and draw-
ing the correct conclusions from the research, it is entirely
possible to derive information about the command which may be
very far-reaching in impact. Until something is known about
the nature of the relationships between the various command
echelons it is difficult to establish either an optimal
management information system or any meaningful measure of
unit efficiency. These relationships are complex management
equations which are influenced by many internal and external
factors, some of which may wield greater power than is present-
ly known. Therefore, the answer to the basic question of goal
congruence appears to be essential for meaningful evaluation
of the command management system as a whole.

Objectives and Purpose of Research

1. To insure that the question of goal congruence can
be addressed for the entire command while at the same time
limiting the research to managable proportions, it is pro-
posed that AFCS sponsor two separate, but related, simultan-
eous research endeavors. One of these would be directed at
the MAJCOM/Area interface and the second would address the
Area/ operating unit relationship. Contact has been made
with a second AFIT student, Captain Jacob P. Miller, who is
interested in pursuing research in this area, and with a
member of the AFIT faculty who has indicated not only in-
terest in the research but willingness to serve as a con-
sultant to AFCS for this and any follow-on effort which may

result. The faculty member, Lt Col Adrian Harrell, holds a Ph.D. in accounting and has conducted a study similar to that proposed here as a basis for his doctoral dissertation.

2. The product of the research herein proposed would be a potentially powerful management aid to AFCS. The research could also be used as the basis for comparative analysis against other studies or as the starting point for further scientific management study within the command. The research should prove to have considerable utility to the command in developing and producing an effective management information system and for other management applications.

Methodology

1. The data collection method for the proposed research has not yet been fully developed, since there are some points which must be jointly decided upon by the command and those conducting the research. The suggested approach involves a field experiment to collect data related to the decision-making policies of middle management personnel throughout the command. By selecting appropriate decision criteria and testing randomly selected personnel at the headquarters, Areas and operating units it is hoped that a basis may be established for determining the degree to which these personnel are in agreement in interpreting policy and to determine the respective weights that various levels place on the pre-selected decision criteria. Specifically, each participant would be asked to evaluate a number of hypothetical AFCS units on the basis of whether or not the decision criteria were satisfied for each unit. The proposed decision criteria

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should be selected on the basis of relevance, independence, and uniformity of interpretation (lack of ambiguity). The following criteria appear to meet these requirements: personnel factors, quality of service factors, compliance factors, and maintenance quality factors.

a. Personnel. Includes factors such as morale/ welfare programs, unit disciplinary rates, IG complaint rates, retention rates.

b. Service Quality. Factors related to the service provided to the customer by the unit being evaluated. Measured by means of speed of service, message handling time, operator courtesy, air traffic control quality, responsiveness to new requirements, etc.

c. Compliance. Factors related to how closely the unit follows AF, AFCS, and Area directives as determined by IG reports, ATC analysis reports, staff visit reports.

d. Maintenance Quality. Factors indicative of maintenance effectiveness and efficiency, such as ready rates, uptime rates, etc.

2. Assuming agreement on these four decision criteria, each participant would evaluate a total of 16 hypothetical units, rating each unit on a scale of 1 through 8 (highly unsatisfactory to highly satisfactory) based on preassigned grades of satisfactory or unsatisfactory for each of the decision criteria. Sixteen is the number of units chosen for the test in order to cover all possible combinations of grading (S or U) of all four decision criteria (see figure 2). The assignment of the grades of S or U to the criteria

would be done in a random fashion to avoid possible sequential biases and the evaluated units would be arranged in random order to discourage "gaming." The evaluation sheets would appear essentially as shown in figure 1. The data thus collected would be subjected to the appropriate statistical analysis to determine what, if any, relationship there is between decisions made at various levels of the command.

3. In view of the complexity of the AFCS organization and command lines it would be surprising if the proposed field experiment did not yield some highly interesting results. It is entirely possible that external factors could have significant impact on unit response to AFCS/ Area policy and direction. Conversely, it is also possible that there is a very close coincidence of goals between the various echelons. The latter case could indicate that greater autonomy than is presently thought possible would produce greater efficiency and better service to AFCS customers. In either case, the field experiment should be of significant benefit to AFCS and the cost of this effort to the command would be very small compared to the cost for use of a professional consulting service.

4. If the command accepts sponsorship of the proposed research project, the following tenative schedule would apply:

        a. Finalization of field experiment brochure: Jan 77

        b. Completion of literature survey: May 77

        c. Conduct of field experiments: 1-30 Jun 77

        d. Defense of theses: 1 Aug 77

        e. Final thesis to AFCS: NLT 1 Sep 77

Note: This schedule is prolonged due to an unexpected

change in AFIT policy regarding its treatment of the independent study portion of the degree program. It was originally planned that the field experiment could be conducted in the late March - early April time period; however, the new school policy is to extend the independent study phase over two academic quarters instead of one, thus preventing completion of the proposed research by June 1977 as originally indicated.

References

1. Although a complete literature survey has not yet been made relative to the proposed research project, the following are some initial sources of information pertaining to the techniques suggested for this study:

Beach, Lee Roy, "Multiple Regression as a Model for Human Information Utilization." Organizational Behavior and Human Performance, Vol 2, pp 276-289 (1967).

Bottenberg, R.A. and J.H. Ward, Jr., "Applied Multiple Linear Regression." PRL-TDR-63-6, AD-413 128. Lackland AFB, Texas: Personnel Research Laboratory, Aerospace Medical Division, March 1963.

Bottenberg, R.A. and R.E. Christal, "An Iterative Technique for Clustering Criteria Which Return Optimum Predictive Efficiency." The Journal of Experimental Education, Vol 36, No. 4, pp 28-34, Summer 1968.

Christal, Raymond E., "Selecting a Harem - and Other Applications of the Policy-Capturing Model." The Journal of Experimental Education, Vol 36, No. 4, pp 35-41, Summer 1968.

Freund, John E., Mathematical Statistics. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1971.

Horngren, Charles T., Cost Accounting: A Managerial Emphasis. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1972.

2. For further information concerning this proposal,

contact Lt Col Carl G. O'Berry, (513) 236-4376, or Lt Col
Adrian Harrell, Wright-Patterson AFB extension 52549.

FIGURE I

Performance Evaluation of Squadron Number __1__

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . . <u>S</u>

2. The quality of service provided by this squadron
    is rated. . . . . <u>U</u>

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as. . . . . <u>S</u>

4. The quality of maintenance in this squadron is
    considered to be. . . . . <u>S</u>

The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

A P P E N D I X   B

DATA COLLECTION INSTRUMENT

A copy of the data collection instrument for the
field experiment is presented in this Appendix. In addi-
tion to the basic instrument, a copy of the cover letter
signed by the AFCS Chief of Staff is included, as is an
example of the letters used to forward the experimental
exercise to each of the eight senior AFCS executives. In
addition to completing the basic evaluation exercise, each
senior executive was asked to specify the weights he felt
<u>should</u> be applied to each performance criterion, in the
manner shown on the page following the example explanatory
letter.

During the exercise, the subjects were asked to rate
the performance of a number of hypothetical AFCS communica-
tions squadrons, using the information provided as to wheth-
er or not the four performance criteria were satisfied.
Since each criterion was categorized as being either met
(satisfactory) or not met (unsatisfactory), and four per-
formance criteria were used, there were 2^4 = 16 distinct
combinations of these criteria. In this experiment, all 16
possible cases were presented to the subject for his
evaluation.

REPLY TO
ATTN OF: CS

3 MAR 1977

SUBJECT: Decision Making Analysis

TO:

1. The attached exercise is designed to investigate certain aspects of the decision-making behavior of AFCS managers. Request your participation in the exercise by rating the performance of sixteen hypothetical Type I communications squadrons based upon whether each unit is rated satisfactory or unsatisfactory with respect to four different performance criteria. The data gathered will be analyzed statistically and summarized in a thesis to be prepared by Air Force officers studying at the Air Force Institute of Technology. This project is being performed under the sponsorship of HQ AFCS and has full command support.

2. You will not be identified with the data in the final report and your individual responses in this exercise will not be made known to anyone except the officers conducting the study at AFIT. If you wish, an analysis of your decision-making performance will be provided to you at a later date. If you would like to receive this analysis, so indicate on page 3 of this booklet. The analysis will be sent directly to you by the AFIT students conducting the study.

3. Please follow the instructions for this exercise carefully. Your support can help to increase our understanding of AFCS decision dynamics and may aid in finding areas for improvement in management of the command. If you received this booklet by mail, use the enclosed self-addressed envelop to return it promptly to AFIT/ENS. Thank you for your cooperation.

FOR THE COMMANDER

RICHARD W. PRIOR, Lt Col
Chief of Staff

1 Atch
Decision Analysis Exercise

Providing the Reins of Command

DECISION ANALYSIS EXERCISE

PROVIDING the REINS of COMMAND

AIR FORCE COMMUNICATIONS SERVICE

SPRING 1977

AIR FORCE COMMUNICATIONS SERVICE

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NOTICE

This booklet will be returned directly to AFIT/ENS. All
personal data will be removed from the exercise and a numeric
identifier will be attached to each booklet returned. No
personal data will be forwarded to AFCS, nor will any such
data be included in the research report. Collection of the
above data is necessary to validate the authenticity of the
exercise results and to aid in statistical analysis. No
permanent record of personal data will be retained after the
analysis is completed.

BIOGRAPHICAL DATA

Please circle or write in the appropriate response.

1. Are you a military officer or a civilian?

   A. Military officer
   B. Civilian

2. Please indicate your grade.

   A. 0-1   F. GS-9
   B. 0-2   G. GS-10
   C. 0-3   H. GS-11
   D. 0-4   I. GS-12
   E. 0-5   J. GS-13

3. Military officers please indicate your date of rank.
   (Indicate year/month, e.g.: March 1974 = 7403)

   _____

4. What is your present unit?

   A. Hq AFCS
   B. NCA
   C. SACCA
   D. SCA
   E. TCA
   F. Group/Squadron, (Indicate unit number, e.g.: 2046,
      1398)

   _____

5. What is your office symbol?

   _____

6. What year/month were you assigned to your present unit?
   (Indicate as above, e.g.: October 1975 = 7510)

   _____

7. Have you attended a resident PME course other than SOS
   or the Communications-Electronics Staff School?

   A. Yes
   B. No

8. Have you attended the Communications-Electronics Staff School?

   A. Yes
   B. No

9. What was your previous assignment?

   A. MAJCOM   B. Unit Level
      (1) USAF/JCS/DOD   (1) Hq
      (2) ADCOM   (2) Area/NAF
      (3) AFCS   (3) Group/Sq
      (4) MAC   (4) Other _____
      (5) SAC
      (6) TAC
      (7) USAFSS
      (8) Other _____

10. What is your highest level of education?

   A. Less than a bachelor's degree
   B. Bachelor's degree
   C. Graduate work beyond a bachelor degree
   D. Master's degree
   E. Postgraduate work beyond a master's degree
   F. Doctorate degree

11. What was/is your most recent major field of study?

   A. Engineering
   B. Science/mathematics
   C. Management
   D. Other

12. Do you wish to receive an analysis of your performance on this exercise?

   A. Yes
   B. No

13. If you indicated "Yes" in question 12, please print your name here.

   _____

INSTRUCTIONS

In this exercise you are requested to rate the performance of sixteen hypothetical AFCS Type I communications squadrons. The performance criteria upon which you will base your evaluation of each squadron consist of the following:

1. <u>Personnel Programs</u>. Indicates the success of the unit in terms of morale and welfare programs, disciplinary rate, IG complaint rate, retention rate, etc.

2. <u>Quality of Service</u>. Indicates unit success in factors related to the service provided to the customer. Includes such factors as speed of service, message handling time, operator courtesy, accuracy, air traffic control quality, and responsiveness to new customer requirements.

3. <u>Compliance</u>. Indicates how closely the unit being rated follows Air Force, AFCS, and Area directives, as determined by IG reports, Air Traffic Control Analysis reports, and staff visit reports.

4. <u>Maintenance Quality</u>. Indicates maintenance effectiveness and efficiency as reflected by maintenance analysis reports, operational ready rates, uptime rates, etc.

<u>These four performance criteria are to be viewed as independent of one another</u>. A rating of satisfactory or unsatisfactory for any single criterion is not related to, and does not influence, the ratings of the other criteria. You are to use only the information provided for each squadron to rate the overall performance of that unit as one of the following:

1. <u>Highly Satisfactory</u>. Minor deficiencies may exist. Some minor corrective action may be required.

2. <u>Satisfactory</u>. A few significant deficiencies may exist. Some monitoring by the Area staff might be indicated in certain areas.

3. <u>Unsatisfactory</u>. Some major deficiencies exist. Limited on-site Area staff assistance may be required. The replacement of at least one key unit manager might be considered.

4. <u>Highly Unsatisfactory</u>. Many major deficiencies exist. Immediate corrective action and extensive on-site Area staff assistance are required. Replacement of at least one key unit manager is recommended.

Refer to the example on the following page. You may refer back to previously completed evaluations at any time, but do not change any that have already been completed. You may remove this page for easy reference during the exercise if you wish.

Performance Evaluation of Squadron Number __X__

S=Satisfactory   U=Unsatisfactory

1.   Personnel programs in this squadron are rated. . . . __S__

2.   The quality of service provided by this squadron
      is rated . . . . __S__

3.   Compliance with AF/AFCS/Area directives in this
      squadron is rated as . . . . __S__

4.   The quality of maintenance in this squadron is
      considered to be . . . . __S__

      The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	
						✕	

Performance Evaluation of Squadron Number __1__

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . _S_

2. The quality of service provided by this squadron
    is rated . . . . _U_

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . _U_

4. The quality of maintenance in this squadron is
    considered to be . . . . _U_

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number __2__

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . __U__

2. The quality of service provided by this squadron
    is rated . . . . __S__

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . __S__

4. The quality of maintenance in this squadron is
    considered to be . . . . __S__

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number __3__

S=Satisfactory   U=Unsatisfactory

1.   Personnel programs in this squadron are rated. . . . __S__

2.   The quality of service provided by this squadron
     is rated . . . . __U__

3.   Compliance with AF/AFCS/Area directives in this
     squadron is rated as . . . . __U__

4.   The quality of maintenance in this squadron is
     considered to be . . . . __S__

     The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

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Performance Evaluation of Squadron Number __4__

S=Satisfactory   U=Unsatisfactory

1.   Personnel programs in this squadron are rated. . . . __U__

2.   The quality of service provided by this squadron
     is rated . . . . __S__

3.   Compliance with AF/AFCS/Area directives in this
     squadron is rated as . . . . __S__

4.   The quality of maintenance in this squadron is
     considered to be . . . . __U__

     The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number 5

   S=Satisfactory   U=Unsatisfactory

1.   Personnel programs in this squadron are rated. . . . _S_

2.   The quality of service provided by this squadron
     is rated . . . . _S_

3.   Compliance with AF/AFCS/Area directives in this
     squadron is rated as . . . . _S_

4.   The quality of maintenance in this squadron is
     considered to be . . . . _S_

     The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory	Highly Satisfactory	

END
DATE
FILMED

11-77

DDC

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

Performance Evaluation of Squadron Number __6__

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . __S__

2. The quality of service provided by this squadron
    is rated . . . . __S__

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . __U__

4. The quality of maintenance in this squadron is
    considered to be . . . . __U__

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number ___7___

    S=Satisfactory   U=Unsatisfactory

1.   Personnel programs in this squadron are rated. . . . ___U___

2.   The quality of service provided by this squadron
       is rated . . . . ___U___

3.   Compliance with AF/AFCS/Area directives in this
       squadron is rated as . . . . ___U___

4.   The quality of maintenance in this squadron is
       considered to be . . . . ___S___

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number __8__

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . __S__

2. The quality of service provided by this squadron
    is rated . . . . __S__

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . __S__

4. The quality of maintenance in this squadron is
    considered to be . . . . __U__

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number ___9___

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . ___U___

2. The quality of service provided by this squadron
    is rated . . . . ___S___

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . ___U___

4. The quality of maintenance in this squadron is
    considered to be . . . . ___S___

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number 10

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . <u>S</u>

2. The quality of service provided by this squadron
    is rated . . . . <u>U</u>

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . <u>S</u>

4. The quality of maintenance in this squadron is
    considered to be . . . . <u>U</u>

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

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Performance Evaluation of Squadron Number 11

S=Satisfactory   U=Unsatisfactory

1.   Personnel programs in this squadron are rated. . . . _U_

2.   The quality of service provided by this squadron
      is rated . . . . _U_

3.   Compliance with AF/AFCS/Area directives in this
      squadron is rated as . . . . _S_

4.   The quality of maintenance in this squadron is
      considered to be . . . . _S_

      The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number __12__

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . __U__

2. The quality of service provided by this squadron
    is rated . . . . __U__

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . __U__

4. The quality of maintenance in this squadron is
    considered to be . . . . __U__

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number 13

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . . S

2. The quality of service provided by this squadron
    is rated . . . . U

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . S

4. The quality of maintenance in this squadron is
    considered to be . . . . S

The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number __14__

S=Satisfactory   U=Unsatisfactory

1.   Personnel programs in this squadron are rated. . . . __U__

2.   The quality of service provided by this squadron
     is rated . . . . __U__

3.   Compliance with AF/AFCS/Area directives in this
     squadron is rated as . . . . __S__

4.   The quality of maintenance in this squadron is
     considered to be . . . . __U__

     The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number 15

S=Satisfactory   U=Unsatisfactory

1. Personnel programs in this squadron are rated. . . . S

2. The quality of service provided by this squadron
    is rated . . . . S

3. Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . U

4. The quality of maintenance in this squadron is
    considered to be . . . . S

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

Performance Evaluation of Squadron Number 16

    S=Satisfactory   U=Unsatisfactory

1.   Personnel programs in this squadron are rated. . . . U

2.   The quality of service provided by this squadron
    is rated . . . . S

3.   Compliance with AF/AFCS/Area directives in this
    squadron is rated as . . . . U

4.   The quality of maintenance in this squadron is
    considered to be . . . . U

    The overall performance of this AFCS squadron should
be evaluated as:

Highly Unsatisfactory		Unsatisfactory		Satisfactory		Highly Satisfactory	

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24 May 1977

Colonel James L. Hodge
AFCS/LG
Richards-Gebaur AFB, MO 64030

Dear Colonel Hodge:

Several weeks ago copies of the attached analysis exercise were distributed to over 600 AFCS middle managers at the Headquarters, three different Areas, and numerous units. The purpose of the exercise is to capture each individual's unit rating policy, given specified evaluations of sixteen hypothetical units in terms of four performance criteria common to AFCS. More than 500 of the exercises have been completed and returned to me. The data thus gathered are being analyzed by myself and another AFIT graduate student with the intent of identifying, if possible, any differences in rater policies at the various levels of the Command.

While we are concentrating our basic study on the middle management segment of AFCS (O-1 through O-5 and GS-9 through GS-13), we would also like to have a standard taken from among the most senior officers of the Command with which to compare the weights given the performance criteria by AFCS middle managers. You can assist us in this effort if you will take a few moments from your busy schedule to complete the attached exercise, ignoring the request for biographical data at the beginning. It is our intent to use the data collected from you and other senior AFCS managers to calculate a figure of merit for comparison purposes.

I realize that some senior people might well feel uncomfortable if asked to reveal their personal unit evaluation policies. In order to assure that your personal policies cannot be identified, I have asked the Head of the AFIT Systems Management Department, Colonel Ronald A. Luhks, to act as a disinterested collection agent for the data requested above. If you will have your secretary return the completed attachment to him, Colonel Luhks will remove any identifying information and turn only the sterilized results over to me.

This study has been conducted under AFCS sponsorship and the results will be presented to AFCS/OA in the form of a graduate thesis which I hope to complete by early July. I honestly believe that we can help to improve understand-

ing of the complex interfaces between the different AFCS
command levels through this research effort. Please try
to find the time to provide us with your valuable input
to this effort and have your secretary return the com-
pleted attachment to:

      Colonel R.A. Luhks
      AFIT/ENS
      Wright-Patterson AFB, OH 45433

Sincerely,

CARL G. O'BERRY, Lt Col, USAF

Please indicate in the space provided next to each performance criterion the importance you feel <u>should be</u> associated with that factor when assessing the overall performance of an AFCS unit. Use a total of 100 points as indicated (the more important you feel a factor is, the more points it should receive):

<u>Personnel Programs</u> (the success of the unit in terms of morale and welfare programs, disciplinary rates, IG complaint rate, retention rate). _____

<u>Quality of Service</u> (unit success in factors related to the service provided to the customer). _____

<u>Compliance</u> (the degree to which the unit adheres to higher headquarters directives). _____

<u>Maintenance Quality</u> (maintenance effectiveness and efficiency). _____

Total   100

Now please proceed with the remainder of the exercise.

A P P E N D I X C

FEEDBACK PROVIDED TO SUBJECTS

Each experimental subject was afforded the opportunity
to request an analysis of his individual performance in the
decision exercise, as an incentive to improve the response
rate. A computer program was prepared to generate the in-
dicated feedback to the subject, as shown in this Appendix.
The computer program selected the subject on the basis of a
coded data entry, calculated his individual relative pre-
dictor weights and consistency index (R^2), and printed the
indicated message. The analyses were mailed in bulk to the
appropriate units for distribution to participants who had
requested the feedback.

NAME: DOUGLAS L. MORQUIN   UNIT: F1905CC

THANK YOU FOR PARTICIPATING IN OUR RECENT AFCS DECISION ANALYSIS EXERCISE. YOU REQUESTED THAT WE PROVIDE YOU WITH AN ANALYSIS OF YOUR PERFORMANCE IN THAT EXERCISE. THE FOLLOWING STATISTICS COMPARE YOUR 16 UNIT EVALUATIONS AGAINST THOSE MADE BY ALL PARTICIPANTS AS A GROUP. THE WEIGHT SHOWN FOR EACH PERFORMANCE FACTOR IS THE RELATIVE IMPORTANCE GIVEN THAT FACTOR IN DECIDING HOW THE UNIT SHOULD BE EVALUATED OVERALL.

	WEIGHTS ASSIGNED BY ALL PARTICIPANTS AS A GROUP:	WEIGHTS USED BY YOU IN EVALUATING THE 16 HYPOTHETICAL UNITS:
PERSONNEL FACTORS	.14	.03
QUALITY OF SERVICE	.49	.36
COMPLIANCE	.14	.09
QUALITY OF MAINTENANCE	.23	.52

THE CONSISTENCY WITH WHICH YOU APPLIED THE WEIGHTS INDICATED ABOVE IN EVALUATING THE UNITS WAS 97.9%. THE CONSISTENCY DISPLAYED BY ALL 513 PARTICIPANTS AS A GROUP WAS 78.5%. THIS MEANS THAT YOUR PERSONAL EVALUATION POLICY, ONCE ESTABLISHED, WAS EFFECTIVELY APPLIED IN 97.9% OF THE DECISIONS YOU MADE IN THE EXERCISE, AS OPPOSED TO CONSISTENT POLICY APPLICATION IN 75.8% OF THE DECISIONS MADE BY THE COLLECTIVE TEST GROUP.

THANKS ONCE AGAIN FOR YOUR COOPERATION AND PATIENCE.

LT COL C.G. O'BERRY
CAPT J.P. MILLER
AFIT/ENS
WRIGHT-PATTERSON AFB, OH 45433

A P P E N D I X   D

EXAMPLE OF SPSS PROGRAM AND TYPICAL OUTPUT

This Appendix contains an example of the control
cards required as input for the Statistical Package for the
Social Sciences (SPSS) regression algorithm as used in this
study. Also included is a typical last regression step
output, showing the Analysis of Variance (ANOVA) table and
statistics produced by the algorithm.

Since 513 AFCS middle managers responded to this ex-
periment, there were 513 x 16 = 8,208 separate evaluations
made. Each of these decisions is included in the overall
regression model, then the respondents are broken out by
headquarters and Area-grouped operating units for separate
regression runs. The average regression after this grouping
process included more than 2000 evaluations; hence each
model thus produced was quite insensitive to the effects of
extremes in individual evaluation cases. The data base was
screened for obvious attempts to introduce inaccuracies
(marking all entries high or low, choosing all the same
values, etc.), but none were detected. If any subject elec-
ted to simply mark his exercise randomly this would not
materially affect the regression outcome, with such large
numbers of decisions being included in each regression run.
It was apparent that some respondents used models to make
their evaluations, since there were six cases out of 513
where ther individual R^2 was 1.000.

VOGELBACK COMPUTING CENTER
NORTHWESTERN UNIVERSITY

S P S S - - STATISTICAL PACKAGE FOR THE SOCIAL SCIENCES

VERSION 6.50 -- APRIL 1, 1976

```
      RUN NAME       SENIOR AFCS MANAGER ANALYSIS
      PRINT BACK     CONTROL
      VARIABLE LIST  STATUS,GRADE,DOBYR,DORMO,HDQ,UNIT,OFFSYM,ASGNYR,ASGNMO,PHF,
                     CFSTAFF,PPMAJCOM,PRLVL,FDFLD,ANRO,UNDES,BOOKNR,NAMF,FVAL,
                     P1 TO P4
      INPUT FORMAT   FIXED(2A1,2F2.0,A1,F4.0,A3,2F2.0,2A1,2F1.0,4A1,F2.0,A25,5F1.0)
```

THE INPUT FORMAT PROVIDES FOR 24 VARIABLES. 24 WILL BE READ
IT PROVIDES FOR 1 RECORDS (*CARDS*) PER CASE. A MAXIMUM OF 58 *COLUMNS* ARE USED ON A RECORD.

WARNING - AN ALPHANUMERIC VARIABLE HAS A WIDTH GREATER THAN 10. EXCESS RIGHTMOST CHARACTERS WILL BE LOST.

```
      INPUT MEDIUM     DISK
      N OF CASES       UNKNOWN
      RECODE           UNDES('H'=1)('N'=2)('S'=3)('T'=4)('R'=5)('C'=6)('O'=7)
      MISSING VALUES   STATUS TO FVAL(0)
      REGRESSION       VARIABLES=FVAL,P1 TO P4/
                       REGRESSION=FVAL WITH P1 TO P4(1)/
      OPTIONS          2,11
      STATISTICS       ALL
```

251300 CM NEEDED FOR REGRESSION

105

END OF FILE ON FILE DATA
AFTER READING 112 CASES FROM SUBFILE NONAME

FILE NONAME (CREATION DATE = 06/13/77)

* MULTIPLE REGRESSION *

DEPENDENT VARIABLE.. EVAL

VARIABLE(S) ENTERED ON STEP NUMBER 4.. P1

		ANALYSIS OF VARIANCE	DF	SUM OF SQUARES	MEAN SQUARE	F	SIGNIFICANCE
MULTIPLE R	.87102	REGRESSION	4.	13012.91019	3253.22755	4064.14286	0
R SQUARE	.75858	RESIDUAL	5171.	4139.23432	.80047		
ADJUSTED R SQUARE	.75849						
STD DEVIATION	.89469	COEFF OF VARIABILITY	22.5 PCT				

------------- VARIABLES IN THE EQUATION ------------- | --------- VARIABLES NOT IN THE EQUATION ---------

VARIABLE	B	STD ERROR B	F	SIGNIFICANCE	BETA	ELASTICITY		VARIABLE	PARTIAL	TOLERANCE	F	SIGNIFICANCE
P2	2.2295360	.24871711E-01	8035.5878	0	.6123819							
P4	1.5479284	.24871711E-01	7973.3828	0	.4251662	.28002						
P3	1.1653036	.24871711E-01	2195.5023	0	.19441	.3200962						
P1	1.1538165	.24871711E-01	2152.0395	0	.14637	.3163163						
(CONSTANT)	.91272922	.27807418E-01	1125.0957	.000		.14491						

ALL VARIABLES ARE IN THE EQUATION.

COEFFICIENTS AND CONFIDENCE INTERVALS.

VARIABLE	B	STD ERROR B	T	95.0 PCT CONFIDENCE INTERVAL	
P2	2.2295360	.24871711E-01	89.641440	2.1807769	2.2782951
P4	1.5479284	.24871711E-01	62.236507	1.4991594	1.5966875
P3	1.1653036	.24871711E-01	46.955188	1.1166345	1.2141526
P1	1.1538165	.24871711E-01	46.390716	1.1050574	1.2025756
CONSTANT	.91272922	.27807418E-01	33.542461	.87821493	.98724362

A P P E N D I X   E

CALCULATION OF F-TEST VALUES

The F-Test values used to compare regression models in this study were calculated using the following formula:

$$F_0 = \frac{[SS_e - \sum_{j=1}^{p} SS_{ej}]/[(p-1)(k+1)]}{[\sum_{j=1}^{p} SS_{ej}]/[n-p(k+1)]}$$

where SS_e is the residual sum of squares derived by regressing all compared groups of decisions together, SS_{ej} is the residual sum of squares for the jth group of evaluations, p is the number of groups being compared (number of subsets of data in the regression), k is the number of predictor variables (four, in all cases for this study), and n is the total number of decisions in all groups being compared.

The null hypothesis being tested is:

$$H_0: \underline{\beta}_1 = \underline{\beta}_2 = \underline{\beta}_3 = \ldots = \underline{\beta}_p, \text{ where } \underline{\beta}_i = \begin{matrix} \beta_0 \\ \beta_1 \\ . \\ . \\ \beta_k \end{matrix}$$

The alternate hypothesis is:

$H: \underline{\beta}_i \neq \underline{\beta}_j$, for at least one i,j pair.

The null hypothesis is rejected if:

$$F_0 > F_{\alpha, [(p-1)(k+1)], [n-p(k+1)]}$$

where $\alpha = 0.05$ in all comparisons made for this study.

A P P E N D I X   F

REGRESSION STATISTICS AND RELATIVE WEIGHTS

AFCS RELATIVE PREDICTOR WEIGHTS

REGRESSION GROUP	UNIT
1	ALL UNITS COMBINED
2	HQ AFCS
3	NCA
4	SACCA
5	TCA
6	COMBINED OPERATING UNITS
7	NCA UNITS
8	SACCA UNITS
9	TCA UNITS

109

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 6
K = 4
N = 8209

SPSS REGRESSION RUN BETA WEIGHTS

	ALL UNITS	HO AFCS	NCA	SACCA	TCA	COMBINED OPERATING UNITS
P1	.3282215	.3534649	.3576236	.3302284	.3616129	.3067959
P2	.6095076	.6076046	.5643008	.6301606	.6173115	.6136972
P3	.3212979	.2791534	.3332323	.3140704	.3252636	.3314549
P4	.4193598	.4346199	.4121910	.4170775	.3967088	.4225600

SS(1) = 6932.83279   RSQ(1) = .75832
SS(2) = 893.47437   RSQ(2) = .76104
SS(3) = 818.16979   RSQ(3) = .72728
SS(4) = 786.04348   RSQ(4) = .77875
SS(5) = 617.27047   RSQ(5) = .77501
SS(6) = 3230.18941   RSQ(6) = .75917

RELATIVE WEIGHTS

ALL UNITS	HO AFCS	NCA	SACCA	TCA	COMBINED OPERATING UNITS
RW(1)= .1429632	RW(1)= .1641667	RW(1)= .1759534	RW(1)= .1400331	RW(1)= .1687254	RW(1)= .1739824
RW(2)= .4901981	RW(2)= .4852315	RW(2)= .4378443	RW(2)= .5099228	RW(2)= .4917014	RW(2)= .4961000
RW(3)= .1361330	RW(3)= .1023949	RW(3)= .1576837	RW(3)= .1266648	RW(3)= .1365097	RW(3)= .1447138
RW(4)= .2311098	RW(4)= .2482057	RW(4)= .2336171	RW(4)= .2233755	RW(4)= .2030656	RW(4)= .2352002

F - TEST VALUE FOR COMPARING THE 5 REGRESSION MODELS IN THIS ANALYTIC RUN:

37.99533

110

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2112

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	HQ AFCS	NCA
P1	.3552627	.3534649	.3576236
P2	.5876802	.6076846	.5643008
P3	.3037876	.2791534	.3332323
P4	.4242441	.4346199	.4121910

SS(1) = 1726.19435   RSQ(1) = .74385
SS(2) = 893.47437   RSQ(2) = .76104
SS(3) = 818.16979   RSQ(3) = .72728

RELATIVE WEIGHTS

TWO GROUPS COMBINED	HQ AFCS	NCA
RW(1) = .1695734	RW(1) = .1641667	RW(1) = .1758534
RW(2) = .4642979	RW(2) = .4852315	RW(2) = .4378443
RW(3) = .1240666	RW(3) = .1023949	RW(3) = .1526837
RW(4) = .2419615	RW(4) = .2482057	RW(4) = .2336121

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

7.57370

111

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2224

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	HQ AFCS	SACCA
P1	.3419985	.3534649	.3302284
P2	.6186887	.6076846	.6301606
P3	.2963071	.2791534	.3140704
P4	.4259469	.4346199	.4170775

SS(1) = 1684.77902   RSQ(1) = .76897
SS(2) = 893.47437   RSQ(2) = .76104
SS(3) = 786.04348   RSQ(3) = .77875

RELATIVE WEIGHTS

	TWO GROUPS COMBINED	HQ AFCS	SACCA
	RW(1)= .15221034	RW(1)= .1641667	RW(1)= .1400331
	RW(2)= .4977772	RW(2)= .4852315	RW(2)= .5099228
	RW(3)= .1141760	RW(3)= .1023949	RW(3)= .1256648
	RW(4)= .2359400	RW(4)= .2482057	RW(4)= .2233755

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

1.39709

112

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2049

SPSS REGRESSION RUN BETA WEIGHTS

TWO GROUPS
COMBINED   HQ AFCS   TCA

P1   .3567778   .3534649   .3616129
P2   .6114877   .6076846   .6173115
P3   .2991617   .2791534   .3252636
P4   .4177060   .4346199   .3967088

       SS(1) = 1522.92704   RSQ(1) = .76518
       SS(2) = 893.47437   RSQ(2) = .76104
       SS(3) = 617.27047   RSQ(3) = .77501

RELATIVE WEIGHTS

TWO GROUPS
COMBINED   HQ AFCS   TCA

RW(1) = .1663535   RW(1) = .1641667   RW(1) = .1687254
RW(2) = .4885657   RW(2) = .4852315   RW(2) = .4917014
RW(3) = .1169630   RW(3) = .1023949   RW(3) = .1365097
RW(4) = .2280226   RW(4) = .2482057   RW(4) = .2030656

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

3.28677

113

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 5186

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	HQ AFCS	COMBINED OPERATING UNITS
P1	.3169163	.3534649	.3067959
P2	.6123819	.6076846	.6136972
P3	.3200962	.2791534	.3314549
P4	.4251662	.4346199	.4225600

SS(1) = 4139.23432   RSQ(1) = .75868
SS(2) = 893.47437   RSQ(2) = .76104
SS(3) = 3730.18941   RSQ(3) = .75917

RELATIVE WEIGHTS

TWO GROUPS COMBINED	HQ AFCS	COMBINED OPERATING UNITS
RW(1)= .1323825	RW(1)= .1641667	RW(1)= .1239824
RW(2)= .4942948	RW(2)= .4852315	RW(2)= .4951000
RW(3)= .1350524	RW(3)= .1073949	RW(3)= .1447138
RW(4)= .2332642	RW(4)= .2482057	RW(4)= .2352002

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

3.90730

114

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2995

SPSS REGRESSION RUN BETA WEIGHTS

TWO GROUPS COMBINED	NCA	SACCA
P1	.3429098	.3302284
P2	.5994187	.6301605
P3	.3229459	.3140704
P4	.4147404	.4170775

SS(1) = 1617.43714		RSQ(1) = .75319
SS(2) = 818.16979		RSQ(2) = .72728
SS(3) = 785.04348		RSQ(3) = .77875

RELATIVE WEIGHTS

TWO GROUPS COMBINED	NCA	SACCA
RW(1) = .1551179	RW(1) = .1758534	RW(1) = .1400331
RW(2) = .4770414	RW(2) = .4378443	RW(2) = .5099228
RW(3) = .1384698	RW(3) = .1526837	RW(3) = .1266648
RW(4) = .2283748	RW(4) = .2336121	RW(4) = .2233755

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

3.43907

115

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 1920

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	NCA	TCA
P1	.3594256	.3576736	.3616129
P2	.5896074	.5643008	.6173115
P3	.3293393	.3332323	.3252636
P4	.4046398	.4121910	.3967088

SS(1) = 1442.27451   RSQ(1) = .74902
SS(2) = 818.16979   RSQ(2) = .72728
SS(3) = 617.27047   RSQ(3) = .77501

RELATIVE WEIGHTS

	TWO GROUPS COMBINED	NCA	TCA
RW(1) =	.1724744	.1758534	.1687254
RW(2) =	.4641255	.4378443	.4917014
RW(3) =	.1448084	.1526837	.1365097
RW(4) =	.2185968	.2336121	.2030656

F – TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

1.81873

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

$P = 3$
$K = 4$
$N = 5955$

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	NCA	COMBINED OPERATING UNITS
P1	.3163609	.3576236	.3067959
P2	.6042453	.5643008	.6136972
P3	.3317445	.3332323	.3314549
P4	.4205298	.4121910	.4225600

SS(1) = 4068.89578
SS(2) = 818.16979
SS(3) = 3230.18941

RSQ(1) = .75210
RSQ(2) = .72728
RSQ(3) = .75917

RELATIVE WEIGHTS

	TWO GROUPS COMBINED	NCA	COMBINED OPERATING UNITS
RW(1) =	.1330730	.1758534	.1739824
RW(2) =	.4854572	.4378443	.4961000
RW(3) =	.1461295	.1526837	.1447138
RW(4) =	.2351354	.2336121	.2352002

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

5.11969

117

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 203

SPSS REGRESSION RUN BETA WEIGHTS

	SACCA	TCA
TWO GROUPS COMBINED		
P1	.3302284	.3616179
P2	.6301606	.6173115
P3	.3140704	.3252636
P4	.4170775	.3967088
TWO GROUPS COMBINED		
P1	.3441312	
P2	.6242445	
P3	.3189713	
P4	.4078696	

SS(1) = 1409.25344   RSQ(1) = .77621
SS(2) = 786.04348   RSQ(2) = .77875
SS(3) = 617.27047   RSQ(3) = .77501

RELATIVE WEIGHTS

	SACCA	TCA
TWO GROUPS COMBINED		
RW(1)= .1400331	RW(1)= .1697254
RW(2)= .5099228	RW(2)= .4917014
RW(3)= .1266648	RW(3)= .1365097
RW(4)= .2233755	RW(4)= .2030656
TWO GROUPS COMBINED		
RW(1)= .1525699	
RW(2)= .5020306	
RW(3)= .1310762	
RW(4)= .2143704	

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

1.71161

118

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 5169

SPSS REGRESSION RUN BETA WEIGHTS

TWO GROUPS COMBINED	SACCA	COMBINED OPERATING UNITS
P1	.3117510	.3302284	.3067959
P2	.6171710	.6301608	.6136972
P3	.3277699	.3140704	.3314549
P4	.4213928	.4170775	.4225600

$SS(1) = 4019.20197$ $RSQ(1) = .76309$
$SS(2) = 786.04348$ $RSQ(2) = .77875$
$SS(3) = 3230.18941$ $RSQ(3) = .75917$

RELATIVE WEIGHTS

TWO GROUPS COMBINED	SACCA	COMBINED OPERATING UNITS
$RW(1) = .1273620$	$RW(1) = .1400331$	$RW(1) = .1239024$
$RW(2) = .4991548$	$RW(2) = .5099231$	$RW(2) = .4961000$
$RW(3) = .1407469$	$RW(3) = .1266648$	$RW(3) = .1447138$
$RW(4) = .2327011$	$RW(4) = .2233755$	$RW(4) = .2352002$

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

.76263

119

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 4992

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	TCA	COMBINED OPERATING UNITS
P1	.3164576	.3616129	.3067959
P2	.6141618	.6173115	.6136972
P3	.3302596	.3252636	.3314549
P4	.4178439	.3967088	.4225600

SS(1) = 3461.73947   RSQ(1) = .76100
SS(2) = 617.27047   RSQ(2) = .77501
SS(3) = 3230.18941   RSQ(3) = .75917

RELATIVE WEIGHTS

	TWO GROUPS COMBINED	TCA	COMBINED OPERATING UNITS
RW(1) =	.1315971	.1687254	.1239824
RW(2) =	.4956567	.4917014	.4961000
RW(3) =	.1433255	.1365097	.1447138
RW(4) =	.2294264	.2030656	.2352002

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

1.69807

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2762

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	HQ AFCS	NCA UNITS	
P1	.3348161	.3534649	.3221150	
P2	.6054219	.6076846	.6039127	
P3	.2978479	.2791534	.3106724	
P4	.4268170	.4346199	.4205441	

SS(1) = 2313.39924   RSQ(1) = .74901
SS(2) = 893.47437   RSQ(2) = .76104
SS(3) = 1413.81727   RSQ(3) = .74185

RELATIVE WEIGHTS

TWO GROUPS
COMBINED   HQ AFCS   NCA UNITS

RW(1) = .1495667   RW(1) = .1641667   RW(1) = .1398640
RW(2) = .4833602   RW(2) = .4852315   RW(2) = .4916230
RW(3) = .184408   RW(3) = .1023949   RW(3) = .1301036
RW(4) = .2432190   RW(4) = .2482057   RW(4) = .2384004

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN

1.45167

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

$P = 3$
$K = 4$
$N = 2480$

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	HQ AFCS	SACCA UNITS
P1	.3189534	.3534649	.2904820
P2	.6133575	.6076846	.6180874
P3	.3149648	.2791534	.3445501
P4	.4369942	.4346199	.4390004

$SS(1) = 1917.66626$ $RSQ(1) = .76811$
$SS(2) = 893.47437$ $RSQ(2) = .76104$
$SS(3) = 1006.27949$ $RSQ(3) = .77785$

RELATIVE WEIGHTS

TWO GROUPS COMBINED	HQ AFCS	SACCA UNITS
RW(1)= .1324436	RW(1)= .1641667	RW(1)= .1084782
RW(2)= .4897833	RW(2)= .4852315	RW(2)= .4911384
RW(3)= .1291518	RW(3)= .1023949	RW(3)= .1526191
RW(4)= .2486199	RW(4)= .2482057	RW(4)= .2477616

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

4.55783

122

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2192

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	HQ AFCS	TCA UNITS
P1	.3297064	.3534649	.3044796
P2	.6154454	.6076848	.6241570
P3	.3120239	.2791534	.3474526
P4	.4202266	.4346199	.4040994

SS(1) = 1703.13600   RSQ(1) = .76143
SS(2) = 893.47437   RSQ(2) = .76104
SS(3) = 791.03265   RSQ(3) = .76711

RELATIVE WEIGHTS

	TWO GROUPS COMBINED	HQ AFCS	TCA UNITS
	RW(1) = .1427660	RW(1) = .1641667	RW(1) = .1208534
	RW(2) = .4974496	RW(2) = .4852318	RW(2) = .5078437
	RW(3) = .1275649	RW(3) = .1023949	RW(3) = .1573742
	RW(4) = .2319194	RW(4) = .2482057	RW(4) = .2128721

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

4.82615

123

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

$P = 3$
$K = 4$
$N = 2524$

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	NCA	NCA UNITS
P1	.3349530	.3576236	.3221150
P2	.5892047	.5643008	.6039217
P3	.3108215	.3323233	.3106724
P4	.4173202	.4121910	.4205441

SS(1) = 2245.38359   RSQ(1) = .73516
SS(2) = 818.16979   RSQ(2) = .72728
SS(3) = 1413.81727   RSQ(3) = .74185

RELATIVE WEIGHTS

TWO GROUPS COMBINED	NCA	NCA UNITS
RW(1) = .1526110	RW(1) = .1758534	RW(1) = .1398640
RW(2) = .4722267	RW(2) = .4378443	RW(2) = .4916377
RW(3) = .1382653	RW(3) = .1526837	RW(3) = .1301036
RW(4) = .2368956	RW(4) = .2336121	RW(4) = .2384004

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

3.13790

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2464

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	SACCA	SACCA UNITS
P1	.3080714	.3302284	.2904920
P2	.6233184	.6301606	.6180874
P3	.3309416	.3140704	.3445501
P4	.4291519	.4170775	.4390004

$$SS(1) = 1802.11830 \qquad RSQ(1) = .77713$$
$$SS(2) = 786.04348 \qquad RSQ(2) = .77875$$
$$SS(3) = 1006.27949 \qquad RSQ(3) = .77785$$

RELATIVE WEIGHTS

	TWO GROUPS COMBINED	SACCA	SACCA UNITS
RW(1)=	.1221263	RW(1)= .1400331	RW(1)= .1084782
RW(2)=	.4993496	RW(2)= .5099228	RW(2)= .4911384
RW(3)=	.1409318	RW(3)= .1266648	RW(3)= .1526191
RW(4)=	.2369891	RW(4)= .2233755	RW(4)= .2477616

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

7.54230

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2000

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	TCA	TCA UNITS
P1	.3044449	.3616129	.3044796
P2	.6209472	.6173115	.6241570
P3	.3372976	.3252636	.3474526
P4	.4012187	.3967088	.4050994

SS(1) = 1415.19700   RSQ(1) = .76952
SS(2) = 617.27047   RSQ(2) = .77501
SS(3) = 791.03265   RSQ(3) = .76711

RELATIVE WEIGHTS

TWO GROUPS COMBINED	TCA	TCA UNITS
RW(1) = .1419021	RW(1) = .1687254	RW(1) = .1208534
RW(2) = .5010597	RW(2) = .4917014	RW(2) = .5078437
RW(3) = .1478450	RW(3) = .1365097	RW(3) = .1573742
RW(4) = .2091907	RW(4) = .2030656	RW(4) = .2139270

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

1.94686

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2992

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	NCA UNITS	SACCA UNITS
P1	.3076825	.3221150	.2904820
P2	.6102335	.6039217	.6180874
P3	.3259705	.3106724	.3445501
P4	.4287756	.4205441	.4390004

SS(1) = 2431.30603   RSQ(1) = .75716
SS(2) = 1413.81727   RSQ(2) = .74185
SS(3) = 1006.27949   RSQ(3) = .77785

RELATIVE WEIGHTS

TWO GROUPS COMBINED	NCA UNITS	SACCA UNITS
RW(1) = .1250311	RW(1) = .1398640	RW(1) = .1084782
RW(2) = .4919180	RW(2) = .4916377	RW(2) = .4911384
RW(3) = .1403759	RW(3) = .1301036	RW(3) = .1526191
RW(4) = .2428133	RW(4) = .2384004	RW(4) = .2477616

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

7.76237

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2704

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	NCA UNITS	TCA UNITS
P1	.3152028	.3221150	.3044796
P2	.6117128	.6039217	.6241570
P3	.3249600	.3106724	.3474526
P4	.4144714	.4205441	.4050994

SS(1) = 2210.26524   RSQ(1) = .75093
SS(2) = 1413.81727   RSQ(2) = .74185
SS(3) = 791.03255   RSQ(3) = .76711

RELATIVE WEIGHTS

	TWO GROUPS COMBINED	NCA UNITS	TCA UNITS
	RW(1) = .1323063	RW(1) = .1398640	RW(1) = .1208534
	RW(2) = .4983055	RW(2) = .4916377	RW(2) = .5078437
	RW(3) = .1406243	RW(3) = .1301036	RW(3) = .1573742
	RW(4) = .2287651	RW(4) = .2384004	RW(4) = .2139270

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

1.17334

128

RELATIVE WEIGHTS COMPUTED FOR PREDICTOR VARIABLES, LISTED BY REGRESSION GROUP

P = 3
K = 4
N = 2432

SPSS REGRESSION RUN BETA WEIGHTS

	TWO GROUPS COMBINED	TCA UNITS	SACCA UNITS
P1	.2964117	.3044796	.2904820
P2	.6203914	.6241570	.6180374
P3	.3456229	.3474526	.3445501
P4	.4239911	.4050994	.4390004

SS(1) = 1809.35773   RSQ(1) = .77179
SS(2) = 791.03255   RSQ(2) = .76711
SS(3) = 1006.27949   RSQ(3) = .77785

RELATIVE WEIGHTS

TWO GROUPS COMBINED	TCA UNITS	SACCA UNITS
RW(1) = .1133391	RW(1) = .1208534	RW(1) = .1094782
RW(2) = .4985920	RW(2) = .5078437	RW(2) = .4911384
RW(3) = .1547768	RW(3) = .1573742	RW(3) = .1526191
RW(4) = .2329241	RW(4) = .2139270	RW(4) = .2477616

F - TEST VALUE FOR COMPARING THE 2 REGRESSION MODELS IN THIS ANALYTIC RUN:

3.74645

APPENDIX G

t-TEST VALUES

This Appendix contains the results of t-Test computations for comparing middle management group evaluations against AFCS senior manager evaluations.

AFCS DECISION ANALYSTS

COMPARISON OF DECISIONS MADE BY SENIOR AFCS MANAGERS WITH THOSE OF MIDDLE MANAGERS

(STUDENT T - TEST, ALPHA = 0.05)

AFCS HEADQUARTERS

DECISION NUMBER	T - TEST VALUE
1	6.983
2	3.697
3	2.772
4	-.667
5	1.923
6	.726
7	-.637
8	-.900
9	.535
10	1.363
11	-1.108
12	3.751
13	-.622
14	0.000
15	1.655
16	1.061

DEGREES OF FREEDOM = 69

NORTHERN COMMUNICATIONS AREA

DECISION NUMBER   T - TEST VALUE

1   6.724
2   1.647
3   1.661
4   .216
5   1.462
6   -.592
7   .838
8   -.208
9   -2.030
10   2.305
11   -.183
12   5.801
13   .283
14   2.985
15   -1.139
16   -1.071

DEGREES OF FREEDOM =   60

SAC COMMUNICATIONS AREA

DECISION NUMBER	T – TEST VALUE
1	5.051
2	4.382
3	2.138
4	.343
5	1.008
6	1.125
7	-.478
8	.516
9	-.352
10	.679
11	-.894
12	2.751
13	-1.829
14	1.872
15	-.612
16	1.307

DEGREES OF FREEDOM = 68

TAC COMMUNICATIONS AREA

DECISION NUMBER   T - TEST VALUE

1   4.822
2   2.035
3   3.143
4   -.800
5   .499
6   .284
7   -1.634
8   .247
9   -2.387
10   1.714
11   -1.740
12   4.659
13   -2.020
14   2.258
15   -2.034
16   .909

DEGREES OF FREEDOM =   57

134

NCA UNITS

DECISION NUMBER	T - TEST VALUE
1	4.851
2	6.126
3	2.578
4	-.516
5	1.185
6	-1.145
7	-1.633
8	-.708
9	-.572
10	1.302
11	-1.916
12	2.605
13	-1.221
14	1.168
15	.421
16	.314

DEGREES OF FREEDOM = 101

135

SACCA UNITS

DECISION NUMBER	T - TEST VALUE
1	5.572
2	8.838
3	1.470
4	2.651
5	2.354
6	-.149
7	-.650
8	.430
9	1.983
10	.242
11	.946
12	4.084
13	.269
14	2.916
15	-.239
16	.196

DEGREES OF FREEDOM = 84

TCA UNITS

DECISION NUMBER   T - TEST VALUE

1   4.221
2   4.782
3   1.755
4   1.711
5   -.353
6   -1.338
7   -1.976
8   .269
9   -.593
10   1.521
11   -.760
12   3.574
13   -2.156
14   1.920
15   -2.246
16   .972

DEGREES OF FREEDOM =   66

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V I T A

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The policy-capturing model frequently used in psychological research was adapted in this study to test for goal congruence between managers at different levels of a large service organization of the U.S. Air Force. The data base was derived from a field experiment wherein 660 military officers and civilian managers were asked to make decisions based on identical information cues. The decisions were then grouped according to command level and a multivariate linear regression model was derived for each group. An

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F-test was used to compare these models for equality of regression coefficients, as a determinant of the effectiveness of goal communication between organizational layers. The linear regression model proved readily adaptable as an analytical instrument for organizational study. The results appeared reasonably conclusive, with significant differences in decision-making behavior being indicated at different command levels. Finally, a comparison of the decisions of senior executives against those of various middle management groups was made as a test of the importance of goal congruence. It was found that the decisions of senior managers and subordinate middle management groups, made under identical conditions, differed significantly in some cases. These differences suggest that goal congruence within the Command might have considerable importance, and that it might be improved through a more effective management information system.